In This Issue: The Present Status of the Hetch Hetchy Project

JOURNAL OF ELECTRICITY

VOL. 41 NO. 10 SAN FRANCISCO, NOVEMBER 15, 1918 PER COPY, 25 CENTS

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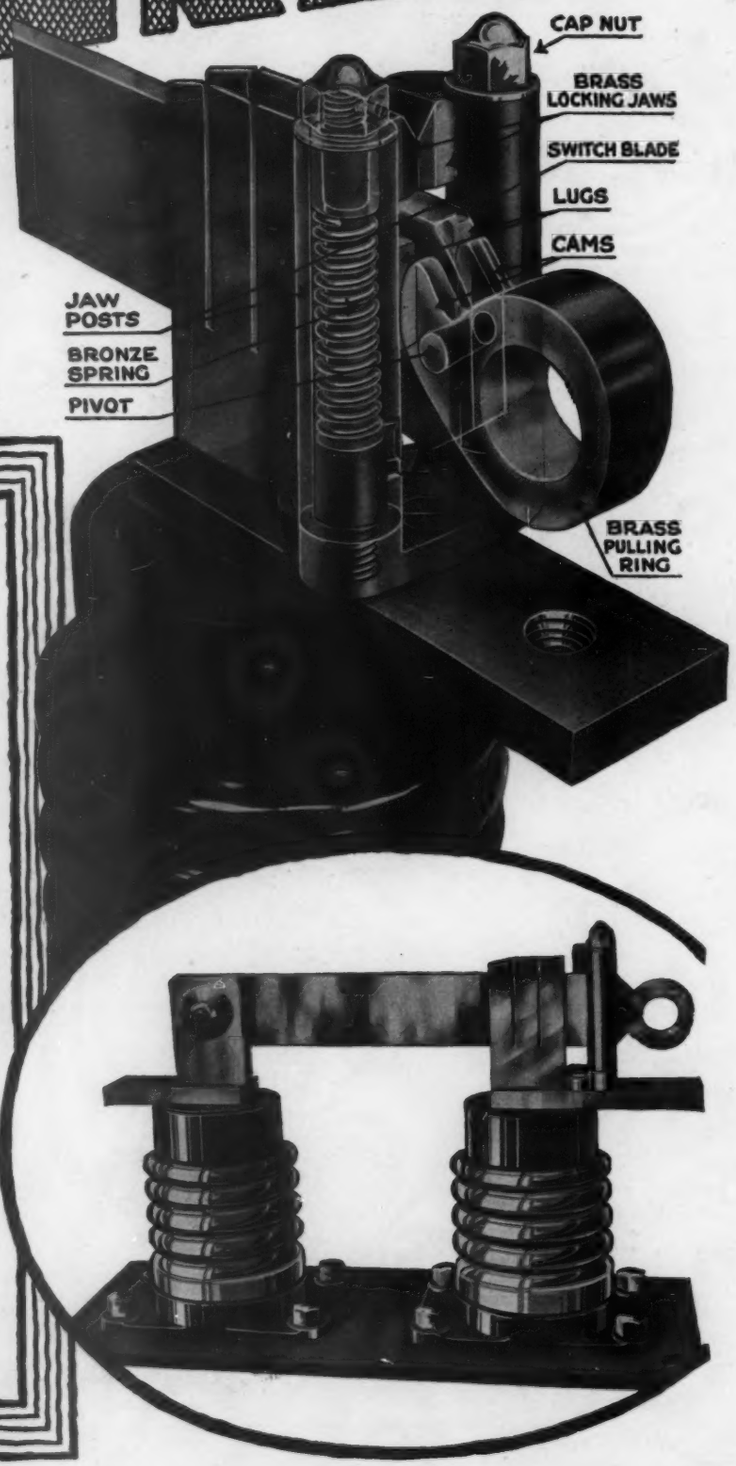

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JOURNAL OF ELECTRICITY

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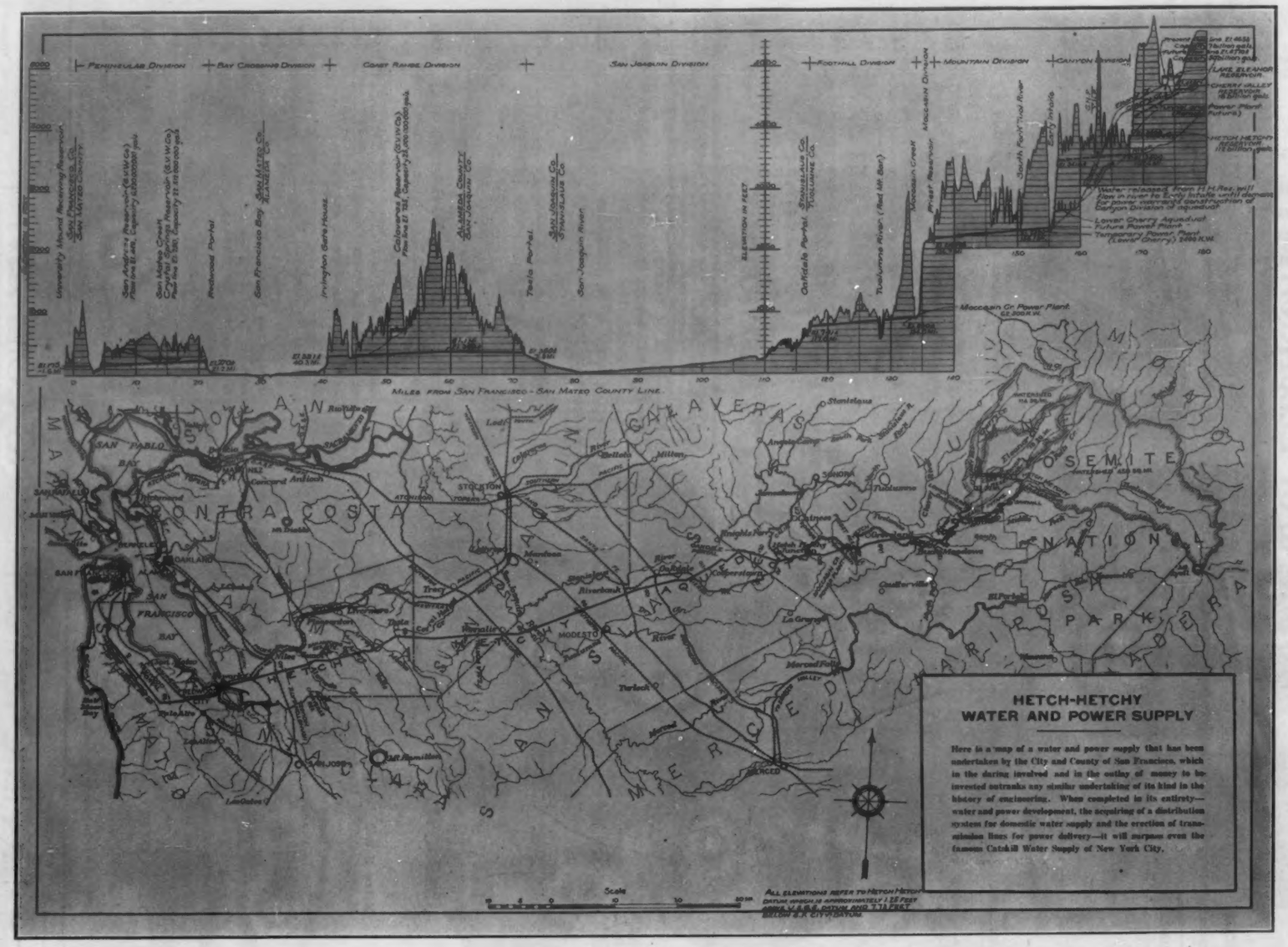

HETCH-HETCHY WATER AND POWER SUPPLY

Here is a map of a water and power supply that has been undertaken by the City and County of San Francisco, which in the daring involved and in the outlay of money to be invested outranks any similar undertaking of its kind in the history of engineering. When completed in its entirety—water and power development, the acquiring of a distribution system for domestic water supply and the erection of transmission lines for power delivery—it will surpass even the famous Catskill Water Supply of New York City.

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JOURNAL OF ELECTRICITY

DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 41 SAN FRANCISCO, NOVEMBER 15, 1918 Number 10

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The Influenza—

After all we have all had colds before and even the grippe. After all, life is more or less made up of germs and danger. If our imagination were but vivid enough, we might all of us live our lives in isolated seclusion, alternating hot foot baths with mustard plasters to combat contagions which we might have acquired or to ward off others yet unknown. Let us be sensible. With due precautions for our outer selves that no others may suffer from our carelessness, with sorrow for the day's reminder of our friends' mortality, let us keep our normal equilibrium of health within.

What of Hetch Hetchy?

The Hetch Hetchy project, when completely developed, includes dams, tunnels, pipes and aqueducts of sufficient capacity to deliver and distribute 400,000,000 gallons of water daily to the San Francisco Bay region from its mountain supply in the high Sierra situated 160 miles to the east. In addition to this, the completed project as now proposed includes the development of a number of attractive power sites, which to properly put in action will require vast electrical equipment and transmission installation.

This completed project will undoubtedly represent an investment of a magnitude of approximately one hundred and twenty-five to one hundred and forty millions of dollars.

A description of this project as it appears today is set forth in this issue with the exception of the Lake Eleanor Dam, which will appear in the next issue of the Journal of Electricity.

In a project of such vast magnitude as this, it is well to be plain and outspoken in statement in order that the public and the vast financial interests involved may proceed in that spirit of mutual cooperation so necessary to bring such a task to a successful consummation.

In the first place there is considerable misunderstanding in the public mind as to the ultimate cost of a project of this magnitude. In his report of March, 1916, the City Engineer of San Francisco sets forth a statement showing that an outlay of $44,147,000 will be necessary to complete the project sufficiently to deliver to San Francisco a domestic water supply of 60,000,000 gallons daily and erect at the Moccasin Creek Power Plant an initial installation of 37,500 kw. Since these estimates were made prices have advanced to such a degree that it is reasonable to expect an outlay of $60,000,000 will be necessary for this work. To acquire a distribution system such as the Spring Valley and the necessary reserve reservoirs an additional $40,000,000 will be necessary. To eventually complete the project so as to deliver the 400,000,000 gallons daily and in addition to erect power lines and build all the other necessary appurtenances will require at least an additional $25,000,000, and many engineers conversant with the project state this figure will approach nearer $40,000,000.

That this completed project may thus cost between $125,000,000 and $140,000,000 does not in itself condemn the undertaking. We are all used to big figures in these days of billion dollar loan drives. It does, however, indicate a vastness of investment of such a magnitude as to bring forth the most serious and earnest solicitude and inquiry from all quarters.

Tersely put, the outstanding facts are these: Some twenty cities and municipalities in the San Francisco Bay region need improved water facilities, and the need is far greater than is generally realized. While the Hetch Hetchy project has been passed on by noted experts, its alternative possibilities of development have never been properly weighed in careful analysis. The power phase of the situation, while attractive on the surface, has never been completely and thoroughly passed upon by outside experts. The project as a whole is admittedly larger than San Francisco of its own self can reasonably finance or, without supplying other municipalities, reduce to a paying investment. Due to the urgent and dangerous situation that may arise from a season of water shortage extending over a two-year period, which may arise at any time, would it not be a wise move for all the cities and municipalities of the San Francisco Bay region to appoint immediately a board of, say, three competent engineers, at salaries commensurate with the magnitude and importance of the task involved, to thoroughly go into every possible phase of the situation of domestic water supply and indeed of the attractive power features that may enter in considering any proposed scheme of development, and report to these municipalities upon a comprehensive plan of harmonious and concerted action for the immediate future? In appointing this board

of three engineers one might well represent San Francisco, one the three larger cities across the bay and one the remaining communities involved.

This is a day for mutual cooperation and is it not well to ask the question as to whether the great Hetch Hetchy scheme of water and power development can ever hope to prove a profitable adventure unless the various cities to whom water and power are to be delivered—the people themselves who are to be taxed and the investors who are to be asked to furnish the money—are completely and thoroughly convinced that the project is wise and to the best interests of all concerned?

Conserving the Condenser Tubes

The condenser for high vacuum has advanced to such importance in power plant economy in the modern steam electric plant that its efficient operation is a matter of prime importance.

To procure new condenser tubes at this period is almost an impossibility. Indeed the requirements of the Navy and the Emergency Fleet Corporation for non-ferrous condenser tubes are so large that the indications are that there will be none, or at best a very small supply of such tubes available on land condensers. In view of this fact the electric and power equipment section of the War Industries Board is emphasizing the seriousness of the situation and urging the necessity of conserving condenser tubes in every possible way.

The loss of even a small point in vacuum is a matter of considerable lowering in economy in the steam electric power plant. Unusual precautions should as a consequence be taken in all steam electric plants to keep the condenser tubes in as perfect a state of conservation as possible.

Helping the Fuel Administration

The federal fuel administrators of the various commonwealths of the West are doing excellent work in forwarding educational and technical information regarding improved methods of conserving fuel and increasing the economy of power plants.

In California this effort has extended to unusual bounds in its usefulness. An administrative engineer has been appointed who in turn has the services of a number of prominent engineers in various localities of the state to assist in the work, as announced elsewhere in this issue.

The Journal of Electricity in full appreciation of the splendid results that are possible from such a movement as this, has offered the use of its columns to the Fuel Administration for technical demonstrations. This offer has been promptly accepted and in the near future a valuable series of contributions by noted engineers in the industry will appear on the subject of fuel conservation by such men as A. E. Schwabacher, Federal Fuel Administrator for California, David M. Folsom, Pacific Coast Fuel Administrator, and a number of consulting engineers of the West.

The first paper of the series will be by J. M. Wadsworth of the U. S. Bureau of Mines, who is acting as administrative engineer for the federal fuel administration for California. Mr. Wadsworth's paper will be on pulverized coal—a possibility of use for the great lignite and low grade bituminous coals of California and the West, which will appear in the Journal of Electricity Dec. 15, 1918. Later papers will discuss the economic point for conversion from oil fuel to pulverized coal; hotel conservation for fuel saving; hydroelectric possibilities on the Pacific Coast in their relation to fuel saving; the financial and business effects of consolidating in the industries; building laws; and the skip-stop plan and other methods of saving on electric railways of the West.

It is believed that these papers, short and concise, coming as they do from authorities along the lines discussed, will be of great aid in forwarding fuel conservation on the Pacific Coast.

Credits

The articles dealing with building up credits that appear in this issue of the Journal of Electricity and the issue for Oct. 15, 1918, by W. R. Herstein, one of the best known electric supply jobbers in the Southern States, will bear the careful consideration of all men in the industry at the present time when Liberty Loan flotations and other large drafts upon banking facilities are coming in such large and overwhelming demands.

The backbone of credit is seen to be the matter of instilling the spirit of fair play and confidence in all with whom one comes in contact in daily business endeavor. This question of credit has a two-fold meaning in these days of national stress. Its proper building means a stronger national financial fabric and at the same time, if used conservatively, it will add its quota toward reestablishing confidence in the after-the-war period.

It is well to bear in mind that producers, manufacturers and contractor-dealers can do their share in this task by reducing their credit requirements by not over-buying, by carrying as small stocks as practicable, by postponing new construction or expansion of their business and by effecting business economies.

Another Opportunity to Help

Much of the essential work of our army of a general welfare nature has been handed over to non-military organizations. We have all grown to recognize the peculiar advantages of the Red Cross in its voluntary work and the necessity for its support. The care of the army in health, however, is no less essential than when wounded, and this work of caring for the welfare of the troops—evenings, Sundays and during hours of leave and rest—has been largely carried on by the seven organizations represented under the United War Work campaign. The army itself might care for entertainments, for food by the wayside, for library facilities, for canteens, for educating foreign born troops to speak English—but it does not. It has left this work for such organizations as the Y. M. C. A. and the Salvation Army to carry on. Unquestionably it is better so—the touch of human brotherhood and the extra-regulation informality and spon-

taneity of it is worth more than the chocolate on the dusty march or the writing facilities in the trenches. It is the touch of home—of some one who cares for them and is doing something for them, not because it is an army requirement, but because of good feeling and as a friend that gives the precious value to the work. But if we would have this, we must pay for it. You would like to do personally many things for some boy you know—to cheer him up, to give him comforts where you could and God knows, if it will lessen any of the weary pain, to be on hand with cigarettes and writing pads to take the message for his home. Of course we can not pick out our man and travel over there to care for him, but we can help support the agencies who are doing just these things.

Just remember what this war might have meant for our boys if it had not been for the Y. M. C. A. and the Knights of Columbus, yes, and the Salvation Army with its doughnuts and pies in the front trenches and its huts of good cheer. Just remember, too, that though the guns may stop with an early peace, the necessity of the work of these organizations will become only more imperative. Figure out what you can afford for charity for the year, save some for the Red Cross, some for local needs, and then give the remainder, all of it, to the United War Work Campaign.

On Figuring Profits

A valuable chart for the convenient figuring of profits is given on a later page of this issue. Knowing the cost of doing business, its use reduces the process of determining the price at which it is necessary to sell in order to make a certain profit to a mere mechanical following of columns. Mechanical helps, of course, are useful only in shortening the work—the analysis of your business is something which must be an individual affair. It is for you to figure the "cost delivered" of your wares as well as the items which go to make up the "cost of doing business." There is still some confusion on these items, some tendency on the part of retailers who wish to be sure to care for their overhead, to apportion this to unsold stock and figure it in as the cost of the article, on which a profit is to be made. It is perhaps well to bear the relations of capital investment, turnover, overhead and profit carefully in mind.

Briefly, capital is the actual money invested and may be represented by such items as fixtures, stock on hand, accounts receivable and other asset items, as well as actual cash on hand. Overhead expense is not part of the capital account—it is running expense by its very definition and is therefore charged against the business of every month, not against the capital account on which the interest must be earned. It is for this reason that it is figured on the sales of a given period, preferably one year's operation. It is not figured on the theoretical selling price of goods stored on the shelves, as this would mean a large portion of it not covered each month and which must therefore be absorbed later on. It would mean charging the overhead to the investment account, very much as though a man were to charge his rent to the value of his house and increase his selling price by so much for every month it remained vacant.

These considerations greatly simplify the matter of figuring prices. It is not necessary to add the proportionate running expenses of each month to the cost of the goods remaining on the shelves, as they are already charged against the goods sold. The necessity for moving the goods is still apparent, however, for with a preponderance of "stickers," the overhead becomes too much for the business to bear.

Practical Patriotism

The chief problem at the present time is to get material rather than to sell it.

The patriotic desire of the dealer, whether wholesale or retail, should not end with mere observance of the regulations of the War Industries Board in the purchase or sale of material, for there are many ways in which still further conservation of effort and material can be effected.

Never was there better opportunity to dispose of odd goods, odd sizes and slow-selling merchandise. .Clear your stock of all material that does not have a steady demand or give you a rapid turnover.

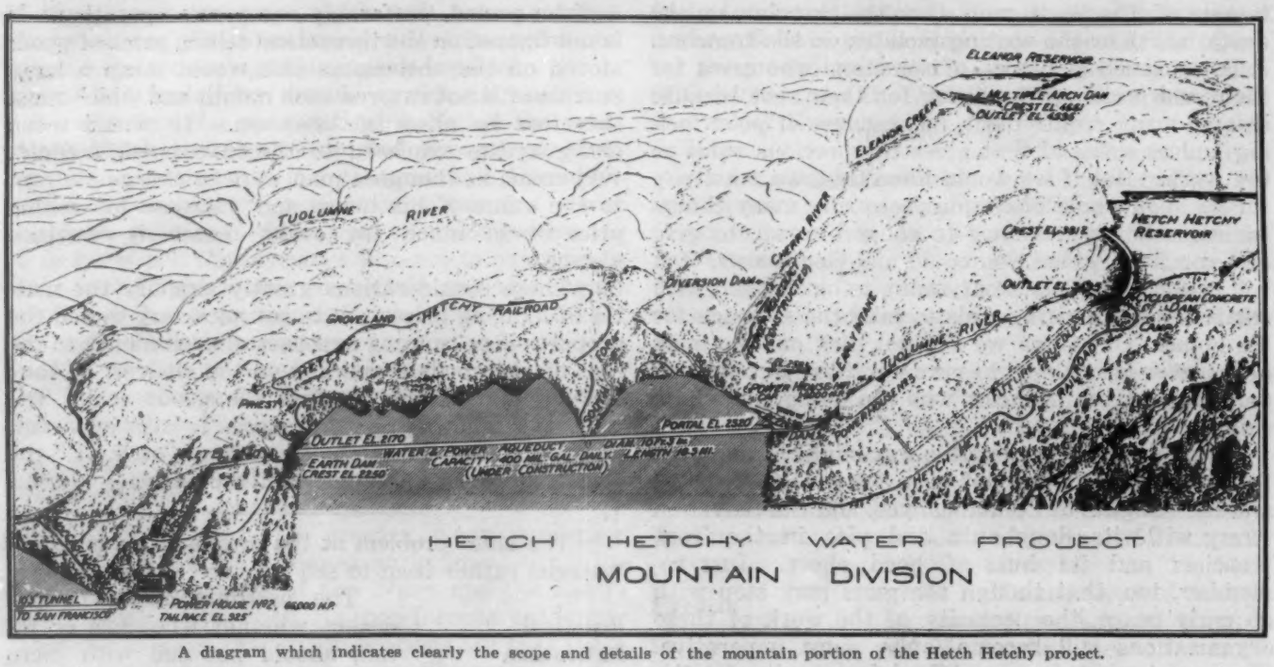
The manufacturers are trying very hard to reduce the number of sizes, styles and finishes of their product in order that available labor and material can be utilized to best advantage. In giving your full support to this movement you not only perform a patriotic duty but benefit yourself as well through reducing your own investment in merchandise.

While, in normal times, the small order evil is a serious problem for both the jobber and manufacturer, under present conditions buying in excess of actual current requirements, even though it may not apparently violate the regulations of the War Industries Board, may be considered unpatriotic.

The greatest care should be taken when placing orders to insure accuracy of specification so as to eliminate the necessity of returning goods.

Dealers who clear up their stocks and buy carefully and conservatively at this time will find themselves in much better financial shape when conditions again become normal than those who have overbought or hoarded material. There is bound to be a readjustment of prices and the dealer with the smallest stock and quickest turnover will be best equipped to meet the change.

THE NEW JOURNAL SERVICE: There has been such demand for the facts and figures setting forth the wonderful world records in the electrical and engineering development of the West with its opportunities, in the Jubilee Issue of the Journal of Electricity of October 15, 1918, that this matter has been gotten together in a forty-four page booklet and is now being distributed throughout the commercial and industrial centers of the East. A limited number of these booklets are still available and a copy will be sent to paid subscribers of the Journal of Electricity in the order of request for the same as long as this limited supply lasts. It is believed that this splendid service in disseminating this forceful data throughout the commercial channels of the nation has resulted in a telling and helpful service for the entire West.

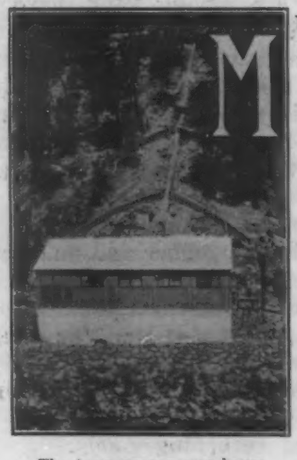


A diagram which indicates clearly the scope and details of the mountain portion of the Hetch Hetchy project.

THE PRESENT STATUS OF HETCH HETCHY

BY RUDOLPH W. VAN NORDEN

(The Hetch-Hetchy water and power project undertaken by the city of San Francisco is one of the most stupendous pieces of work of its kind. Indeed there have been many to prophesy its failure on that ground. Here is presented a most comprehensive survey of the project, its scope and the progress to date as well as difficulties encountered and possibilities for the future. The author is a San Francisco engineer, at one time assistant city engineer, who has recently been over the ground.—The Editor.)



The temporary power house

MUCH comment has been heard, favorable and otherwise, upon the progress of the project of the development of the Hetch Hetchy. Outside of the yearly reports of the City Engineer of San Francisco, however, and occasional fragmentary news articles, there has been very little published which will give the average reader any comprehension of the magnitude of the enterprise in which the city of San Francisco has, for two years or more, been engaged.

For eighteen years San Francisco has had under contemplation the development of a municipal water supply to be obtained from the Tuolumne watershed in the high Sierra Nevadas, which would have the capacity of 400,000,000 gal. per day. This amount had been estimated as the maximum requirement of the city and surrounding communities, together with the supplies already in use, for the next two hundred years. It was also estimated as being the maximum amount of water that could be diverted and stored for this purpose without the danger of a deficiency over a set of seasons of sparce rainfall. In 1913, the question of the right to store this water and use it for municipal purposes in the face of prior rights to the use of the natural flow of the river by the Modesto and Turlock Irrigation Districts, was settled in the Congress of the United States by the passing of the so-called "Raker Bill," which allowed the district 2350 sec. ft., except between the dates

LOGGING OPERATIONS

It will be necessary to clear Hetch Hetchy of timber of course before it is flooded. This shows something of the work already accomplished, which has provided the material for forms and timbering in the construction under way.

each year of April 15 and June 15, when an additional 1650 sec. ft., making 4000 sec. ft. flow, could be diverted to their uses, when it could be beneficially

used. The districts further have the right to purchase surplus water from the city and to create storage of their own, always keeping within the bounds of their flow rights.

Main Features of the Development —

Main Reservoir Sites	Area.	Mean Annual Run-off
Hetch Hetchy	459 sq. mi.	1750 acre-ft. per mi.
Lake Eleanor	79 " "	2260 " " "
Cherry Creek	114 " "	2660 " " "

Plan of Development

Main reservoir at Hetch Hetchy. Tunnel from Cherry Cr. under Eleanor dam with connection for Eleanor water to Hetch Hetchy—capacity 120,000,000 gal. daily. Power

OUTLET TUNNEL AT HETCH HETCHY DAM SITE

The site of the borings made to test rock bottom. Note the white lines up the hillside marking the future position of the dam.

Plant No. 4 where this drops 750 ft. to Hetch Hetchy reservoir—12,000 h.p. Main conduit from Hetch Hetchy dam (10 ft. 3 in. diam.), 12 miles long to Power Plant No. 3—drop of 1190 ft.—60,000 h.p. Water discharged into river, diverted at Early Intake. Second section of conduit tunnel, 18.4 mi., continuous except for South Fork crossing to outlet above Moccasin Creek. Forebay reservoir, pressure tunnel and penstock to Moccasin Cr. power Plant No. 2—drop of 1324 ft.—66,000 h.p. Tunnels and pipe lines from here to University Mound Reservoir in San Francisco—no power development.

Plans for Immediate Procedure

Complete development of tunnels, and one pipe line in order to deliver to San Francisco as soon as possible 60,000,000 gal. daily (if the bay cities come in 120,000,000 gal.). Hetch Hetchy storage plus that already at Lake Eleanor will give 400,000,000 gal. per day at Early Intake—to be utilized at Power Plant No. 2. From here 60,000,000 gal. to go to S. F., remainder returned to Tuolumne for irrigation districts (adequate for Raker Bill requirements). Cherry Creek plans postponed. Power Plant No. 3 not to be undertaken until later and tunnel unit from Hetch Hetchy to Early Intake therefore not needed. Temporary power plant No. 1 for construction purposes and temporary canal to add waters from Eleanor to those of Hetch Hetchy above Early Intake now complete. Eleanor to Hetch Hetchy tunnel not to be commenced at present—to be constructed in order of importance.

Work Done or in Progress —

On so tremendous a construction project as the one thus undertaken the system of organization is extensive and requires time to put in effect. This was commenced in 1914. A headquarters was established at Groveland, which is a central point in what might be called the mountain division of the project. To reach this point it was found necessary to build another road avoiding Priest's grade, maintaining a uniform 5 per cent grade for 7 miles. The county of Tuolumne joined the city in the financial end of the undertaking. This road was completed in the fall of 1915, and was followed by the construction of the Hetch Hetchy railroad.

Work on the first unit of the Lake Eleanor dam was commenced Sept. 1, 1917. From this date to December 22nd, the foundations were excavated and there was poured 2500 cu. yds. of concrete. Work recommenced on April 16, 1918, and the dam was completed in October. This dam, which is of the multiple-arch type, will be described in a subsequent issue of the Journal of Electricity.

The Hetch Hetchy Dam —

At the Hetch Hetchy damsite, work was commenced in September, 1916. A camp was first installed, it being located in a flat whose elevation above the floor of the valley is about 350 ft., and which is but a few hundred feet south of the south end of the damsite. Here a large warehouse at the terminus of the Hetch Hetchy railroad, with a floor

A LINED CANAL IN CONNECTION WITH TEMPORARY POWER PLANT

The combined flow of Eleanor and Cherry creeks is now diverted, conducted through this canal and emptied into the Tuolumne at Early Intake.

area of 14,000 sq. ft., was built, with a hospital, office, houses for the men and a large mess-hall and adequate kitchen to accommodate 500 men at one sitting. It was proposed, before exposing the foundation for the dam, to first build a concrete diversion, above the main damsite, and a diversion tunnel, thereby diverting the main and underflow of the Tuolumne around the damsite. A cofferdam was built in arched form across the canyon, but in sinking this it was found that the bedrock was of too great depth to make such construction practicable, hence after sinking the coffer dam to a depth of 40 feet below the lowest water surface at the damsite, its further construction was abandoned in January, 1917. The work on the diversion tunnel proceeded to completion as it is proposed to use this tunnel as the main water course through the dam after its completion.

Borings Made —

The fact, hitherto unknown, that the bedrock under the dam might be at greater depth than was at first supposed, determined the City Engineer to make a very complete survey, by means of borings, to determine the exact condition and a method of procedure. Accordingly on Jan. 5, 1917, a contract was let to the International Diamond Drill Contracting Company to put down twenty holes at such points as might be designated by the City Engineer, these holes to be sunk into solid bedrock well past any

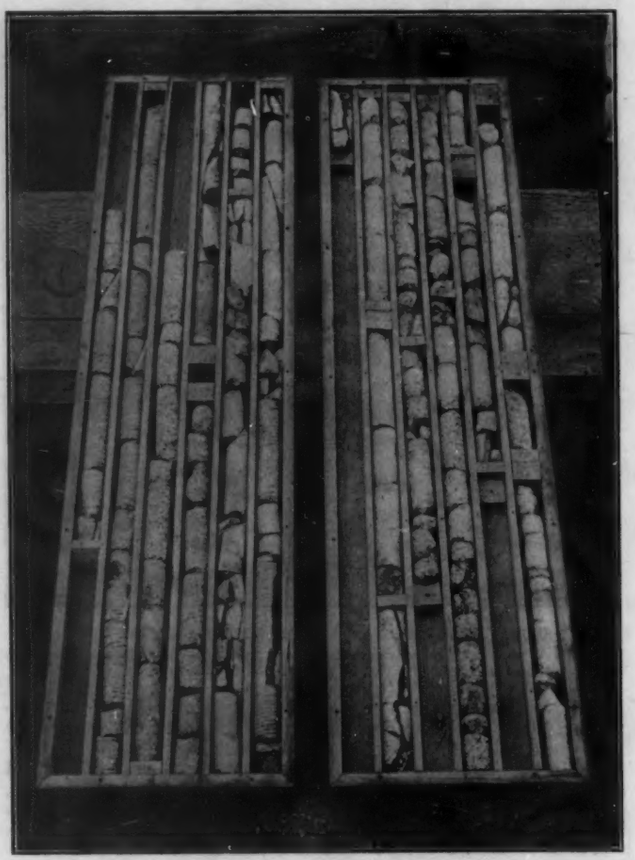
INTERIOR OF TEMPORARY PLANT

This power is now being conveyed to San Francisco over the lines of the Sierra & San Francisco Power Company and there sold commercially.

sign of disintegration or faulting. This work was completed May, 1917. The log of each hole was carefully preserved, the materials being analyzed and properly classified. Boxes 6 ft. long, 18 in. wide and 3½ in. thick with six longitudinal compartments were made — one for each hole — and sample cores taken from each material, or structure encountered, were placed in order therein and marked with the elevations of the changes. In every case the holes were bored many feet below the apparent bedrock surface. The results were then plotted and a contour map of the true damsite was made and from this map a final and accurate location of the dam was possible. This map is shown herewith.

Gravel Accumulation —

In this connection, it is interesting to note that, at a distance of 1400 ft. downstream from the damsite, the bedrock outcrops across the river, forming a natural dam. It is this that has held the gravel and boulder deposit in the bottom of the damsite and which after ages has become well compacted. The true bottom of the channel shelves downward, upstream above the damsite, until, in the open valley, the bedrock is of unknown depth. This phenomenon has probably been the basis of erroneous rumors from time to time to the effect that no bottom could be found for the dam and hence the delay in starting construction. Work is now in progress in which the natural bedrock barrier below the damsite is being removed. Air-operated winch derricks, whose masts are conveniently located standing trees, above this barrier, will hoist out of the bed of the stream thousands of giant boulders, and the flow, now restrained by a low temporary dam, will be allowed to wash out the channel, thereby reducing the gravel bed at the damsite by 20 to 30 ft., and the hydrostatic head on the foundation construction works by the same amount. From the present standing low water at the damsite, to the mean level of bedrock, is about 80 ft.; this then will be reduced to 50-60 ft. After this preliminary clearing out of the channel is completed, work may, finances permitting, proceed on the main foundations. It is proposed here to proceed in a manner similar to that followed in the foundations for the Copco dam for the California-Oregon Power Company. Two arched lines of shafts, similar to mine shafts, are to be sunk across the channel, the one arching upstream at the uppertoe, the other arching downstream at the lower toe.



THE RESULT OF THE BORINGS

The cores taken from the borings at the dam site, showing the quality of bed rock.—See Table below.

These will be timbered as they go down, the water being kept out by pumping. When the bedrock is reached, each shaft will be filled with concrete. These shafts, one after the other, will be sunk and filled until upper and lower barriers are formed which shall be water-tight. The intervening space will be excavated to bedrock and then filled solid with concrete. Upon this the dam structure will be built.

Results of Tests —

Of the twenty drill holes put down, thirteen are under the dam structure, four near midstream and 30-40 ft. above the upper toe, one below the lower toe and the two remaining are 150 ft. above the damsite. The holes, their depth below low water to bedrock and their full depth elevation are herewith tabulated.

The low-water level is taken at El. 3503 and is a standing level without flow.

The construction plant for the dam has not as yet been installed. This will be a modern mixing and

Hole No.	Bedrock El.	Bot. Hole.	Depth below L.W.L
14, Above dam	3540.00	3512.20	(37. ft.+)
19, "	3413.00	3388.25	90.00 ft.
3, "	3427.00	3262.68	76.00 ft.
4, "	3410.00	3365.05	93.00 ft.
13, Under dam	3426.00	3406.25	77.00 ft.
5, "	3438.75	3406.00	64.25 ft.
6, "	3426.00	3400.65	77.00 ft.
6-A, "	3442.00	3408.50	61.00 ft.
17, "	3569.00	3526.00	(66. ft.+)
7, "	3469.00	3440.00	34.00 ft.
8, "	3433.00	3400.50	70.00 ft.
9, "	3443.00	3416.33	60.00 ft.
15, "	3500.00	3472.58	3.00 ft.
10, "	3423.00	3399.75	80.00 ft.
11, "	3401.00	3390.33	102.00 ft.
2, "	3394.00	3226.00	109.00 ft.
18, Below dam	3438.00	3414.80	65.00 ft.

rock crushing plant capable of making and handling up to 2000 cu. yd. concrete per day. There is installed an inclined tramway from the railroad which circles the hill above the south end of the damsite, and joins the main line above the camp. By this arrangement, cars of materials may be brought to the construction plant, emptied of their loads and hauled on in a continuous line without reversal of the forward movement. A steam compressor plant with a displacement of capacity of 800 cu. ft. per min. of free air at 100 lbs. pressure is in operation. This is located by the railroad at the head of the tramway.

Road to Lake Eleanor —

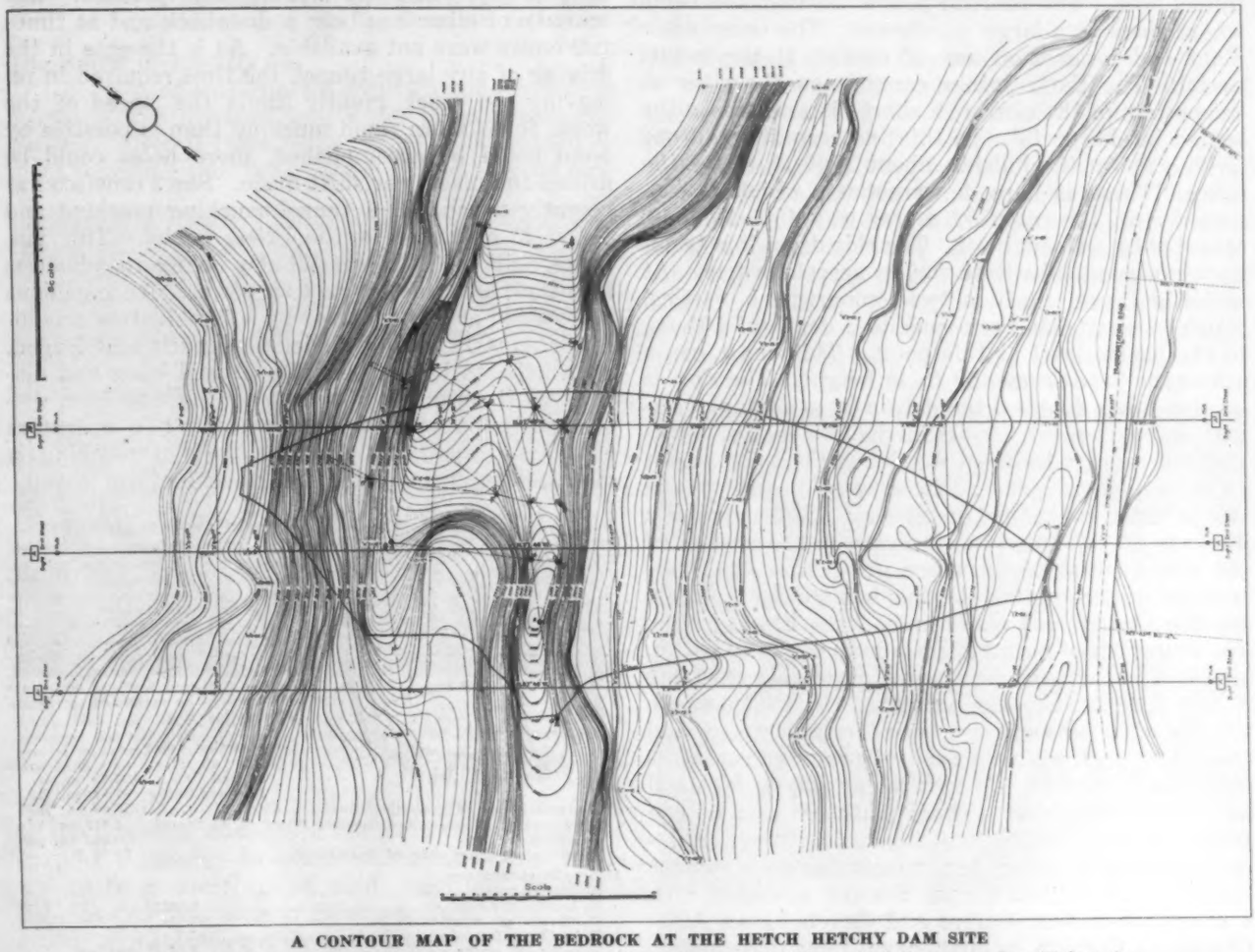
In order to get supplies and materials to Lake Eleanor for the first dam unit, now completed, a road was necessary, from the terminus of the Hetch Hetchy railroad. Work on this road was commenced in May, 1917, and the road was completed to Eleanor, a distance of nine miles, in August, 1917. This road includes a grade from "Damsite" camp, starting at the warehouse, down to the valley floor, thence over a composite single span truss highway bridge, crossing the Tuolumne, thence by zigzagging with an average grade of 16%, to the summit of the ridge north of the damsite, a climb of 1800 ft., thence over more or less hilly country to Lake Eleanor camp. Materials for the Eleanor dam were transported entirely by 3- and 4-ton motor trucks which regularly made two round trips a day during the summer.

Timber Cutting —

During the summers of 1916 and 1917, the standing timber in the floor of the Hetch Hetchy valley, of which there was a large quantity, was all cut and piled into cordwood, although many large logs were saved which will later be floated to where they may be hauled up onto cars and transported to the sawmill.

Saw Mill —

On a work of this magnitude, much lumber is required. The upper Tuolumne country contains vast stores of primeval lumber, heretofore unreachable. The city in 1913 purchased two tracts of



A CONTOUR MAP OF THE BEDROCK AT THE HETCH HETCHY DAM SITE

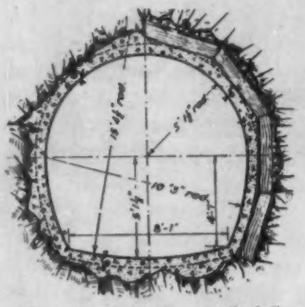
Owing to an outcropping of bedrock at a narrow point below the dam site, this part of the canyon has filled up to considerable depth with gravel and miscellaneous deposit. This is in part to be washed away before construction.

standing timber known as the Canyon and Dudley ranches, lying about five miles west of the damsite. This timber is above and close to the line of the Hetch Hetchy railroad. A camp was built here and a sawmill having a capacity of 17,000 B-M ft. per day was installed. During 1916 this mill turned out over 1,600,000 board-ft. of rough lumber and a quantity of surfaced stock, at a cost of $10.00 per M. B-M.

Main Pressure Tunnel —

The more recent and by far the most extensive of the various enterprises, so far commenced and proceeded with, with perhaps the exception of the Hetch Hetchy railroad, is the tunnel unit between Early Intake and the Priest Portal, above Moccasin Creek. Work on this unit was commenced in September, 1917. There have been established, to date, four tunnel camps. These are, at Early Intake, South Fork, Big Creek Shaft and Priests Portal. These camps are, in general, similar in their equipment, so far as accommodations and feeding are concerned, substantial houses being provided for the men, clean mess rooms and kitchens well equipped, good cooking and food in ample quantity and quality. Board costs $1.25 per day. The Early Intake camp is the oldest and largest because of its use in the construction of the temporary power plant before work on the tunnel was started. The South Fork camp is on the brow of a hill about 800 ft. above the tunnel level. The railroad passes through the camp where there is a large warehouse. The compressor plant and forge shop are, of course, at the tunnel portal. The Early Intake camp is on the river at the bottom of the canyon, a short distance above the tunnel intake portal. In this instance the railroad is high up on the hillside, about 1700 ft. above the camp. There is here a warehouse which is connected with the camp by a tramway 4000 ft. long, operated by a steam hoist. The ride down this tramway is a good substitute for an aeroplane trip. At the Big Creek shaft, a two-compartment vertical timbered shaft has been sunk to a depth of 500 ft., to the tunnel level at this point. This shaft has a mine-type head-frame, 50 ft. in height. The skip is operated by a double drum driven by a 150 h.p., variable speed General Electric induction motor. This shaft is seven miles from the South Fork portal, but as there will be seven adits between the shaft and the portal, the heading to the east will be carried a distance of 1¼ miles only. Between the shaft and the Priest outlet portal, there will be one shaft 650 ft. deep, at Second Gorrote, this being 2.8 miles from the Big Creek shaft and 4 miles from Priest portal. The Priest outlet portal camp is located at the portal. Here is also located the site for the forebay reservoir of the Moccasin Creek power plant; from this camp, therefore, is being handled both the tunnel work and reservoir construction. Each of the four construction camps has an air-compressor plant, identical in capacity and type. These plants consist of one Laidlaw-Dunn-Gordon, two-stage, compressor, cylinders 15-in. by 9 in. by 12 in. stroke, the displacement being 500 cu. ft. free air per minute, equipped with a short-belt-and-idler drive and driven by an Allis-Chalmers, 100 h.p. squirrel-cage induction motor. Air is supplied at 100 lb. per sq. in. pressure and is conducted into the tunnel by 3- and 2-in. wrought iron screw joint pipe. A motor-driven 15-in. blower is also provided, and a 15-in. galvanized pipe carries the fresh air from the blower into the tunnel to the face of the drift. There is also a forge shop, largely for the purpose of sharpening drills for which an Ingersoll-Rand drill sharpener is provided. There are also machine tools for making simple repairs to machinery and equipment. A fully equipped machine shop for making repairs is to be installed at Groveland.

The total length of this tunnel is 18.4 miles, of which the first section between Early Intake and South Fork is 4.5 miles. This section must be worked entirely by two headings, from the Early and South Pork portals, because of the great height of the intervening ground surface, from 1000 to 1800 ft. above the tunnel grade. Work was commenced on tunnel excavation in the Summer of 1917, at Early Intake portal, South Fork outlet, and Priest outlet portal. There being no power at that time available, the drilling was all by hand and progress necessarily slow. Up to the first of July of the present year, when the power installations had been completed and the air-compressors started up, there had been excavated 300 to 400 ft. in each of the three headings. Since July 1st, progress has been more rapid and there had been, to September 1st, an average of 6½ ft. per day when two shifts were operated. The scarcity of labor has been a drawback and at times full crews were not available. As is the case in the driving of any large tunnel, the time required in removing the muck greatly limits the speed of the work, for if more rapid mucking than is possible by hand could be accomplished, more holes could be drilled and blasts per shift made. San Francisco has recently purchased a tunnel mucking machine and put it in operation at the Priest portal. This machine, built by the Myers-Whaley Company, advances into the muck pile by its own power. An ingenious articulated shovel operated by a combination of endless chains is pushed under the muck and loaded, then lifts its load, turns it over and back and discharges it onto a belt conveyor which in turn discharges into a waiting dump car. Two operators shovel and spot cars and the work of mucking is practically continuous. The machine will handle



STANDARD LINED TUNNEL

The method of timbering is not prescribed, but is subject to the approval of the engineers. Logging to be used where necessary. No timber will be allowed to remain within the prescribed line (indicated by dotted line). Standard thickness of lining inside of prescribed line, 6 inches all around. In the timbered section, no points of rock will be permitted to remain within this line.

Cross section areas —

Inside of prescribed line	105.63 sq. ft.
Inside of lining	87.94 sq. ft.
Concrete inside of prescribed line	17.69 sq. ft.
Excavation of prescribed line per linear ft. of tunnel	3.912 cu. yds.
Concrete inside " " " " " "	0.655 cu. yds.
Perimeter, inner side of lining	33.79 ft.

Hydraulic elements —

Hydraulic radius	2.60 ft.
Hydraulic gradient	0.00125
Coefficient of roughness	0.014
C. in Chezy formula	125.5
Velocity of water	7.15 ft. per sec.
Quantity " " flowing	629.3 cu. ft. per sec.
	406.7 million gal. daily

pieces of rock up to 25 in. in any dimension, and will muck and load one ton per minute. It has been found that with the use of this machine, progress per shift of 8 hours, of 6 ft. can be made and it is thought that this, after the work becomes better organized, may be increased to 7 ft. per shift, or, say, an average daily progress from two headings of 30 feet. With work progressing at all of the headings simultaneously, or at least so timed that the completion of the longest drifts will mark the completion of the bore, the tunnel should be completed, ready for the water in 800 days, or say, the summer of 1921. It is the plan to proceed also with the construction of the Moccasin Creek power plant, so that its completion will coincide with the completion of the tunnel, and it is expected that power from this plant will be available by this date. The whole plan of procedure is, of course, predicated upon the ability of the necessary funds to carry it forward.

The course to be taken by the tunnel has been altered slightly from the original planned direct line following the results of diamond drill borings made in the spring of 1917 along the general tunnel course. It was found that the upper half formation encountered is all hard homogeneous granite, but in the lower half, quartz stringers, in some cases carrying good auriferous indications, will be cross-cut also a gravel channel carrying values; and finally a more or less seamy country rock of varied formation, consisting of shale, mica schist and quartz stringers, diorite, slate, and a bastard mixture in spots. Most of these formations require timbering. The tunnel throughout will be lined with concrete, unreinforced, having a nominal thickness of 6 in. It is estimated that the quantity of concrete will average 0.69 cu. yd. per foot of tunnel. At the crossing of the South Fork will be installed a steel pipe, 11 ft. 4 in. diam., the ends of which will be sealed into the portals. The distance between the portals is 300 ft. and the pipe will be supported upon a reinforced concrete arch.

The seven adits which will be drifted into the tunnel course between the South Fork and the Big Creek shaft will have lengths of 100 to 255 ft. and will be horizontal. After the bore is completed these adits will be sealed up.

A UNIQUE METHOD OF HANDLING EMPLOYES

(A unique experiment in company good feeling as worked out by the National Carbon Company of San Francisco. Making employment in your concern more fun than a season ticket to the movies by furnishing a cabaret lunch. The details of the company-employe relationship as it exists in this San Francisco factory.—The Editor.)

The Spirit of Loyalty —

A spirit of enthusiastic loyalty among employes is one of the greatest assets an organization can possess. Even if there be but three in the establishment including the "boss," there should be good feeling here and some element of personal attachment to the business aside from the mere requirements of earning a salary. In offices and small stores this is apt to take the form of staff meetings in which policies and programs are discussed and fully understood, of informal gatherings at the lunch period or home invitations and possibly a yearly picnic.

THE LUNCH HOUR

The tables and lunch counter (in the rear) as viewed from the open space at the end which is left for entertainment features. This is not a special occasion, as might be judged from the decorations, but the everyday aspect of the room.

The National Carbon Company's Plan —

A large factory such as that of the National Carbon Company in San Francisco has a more complicated problem. The employes are of all types and classes, most being occupied with work entirely manual in which little inspiration is to be found in the outlook of the task itself. With the general idea of solving the difficulty and fostering a spirit of contented loyalty, this San Francisco factory set about organizing its work, one thing leading to another until a unique system of inter-cooperation has been worked out.

MAKING THE LUNCH HOUR ENTERTAINING

Orchestra, concert singers and dancers are all part of the working organization of the factory. Note the ferns and flags which help to make the room attractive.

The Factory —

In the first place the entire factory is built and ordered with a view to the health and comfort of employes as well as the efficiency of accomplishment. The concrete floors, high ceilings, generous window facilities and neat arrangement of benches make it possible to preserve attractive surroundings by way of light, air and cleanliness. Although the variety of processes from the making of the cardboard and metal containers to the packing of the core and the sealing of batteries entail the handling of much material of a none too cleanly nature, the factory is nowhere in any measure disorderly and gives the impression throughout of modern open work rooms.

Medical Department —

A medical department is provided with a ward and a nurse in constant attendance. Employes are privileged to bring injuries or personal troubles of any nature for treatment here. For special cases a doctor is called—in the case of minor cuts or burns the first aid treatment is given by the nurse. The dispensary is outfitted in hospital cleanliness and consists of an examination room and ward with beds provided in case of emergency need. A course in first aid is being given to a class of about fourteen young women who give up a short period during their luncheon hour for that purpose once a week. This involves the principles of hygiene and elementary care of the sick and injured and is designed to meet both home needs and to make sure that in case of special need at the factory the employes will not be entirely ignorant of the methods of procedure. At the present time a thorough-going medical inspection of all employes is being undertaken in connection with the tuberculosis work of the state. Thus far no cases have been found, but provision would be made in cooperation with the state for caring for any such in proper country surroundings in order that they might be restored to health and then be able to return to their work.

The Lunch Hour —

The lunch hour presented a problem of no mean proportions. No convenient adequate eating-place was at hand and employes had no recourse but to walk the streets at this hour. Often individuals returned late to their work and too frequently none the better for the period of freedom. It was at length decided to open a lunch room and a portion of the top floor on which the offices are located was given for this purpose. Arrangement was made with a caterer who provides the foods at her own risk and charges a nominal sum for the various dishes. It is possible in this way to procure a generous meal of several courses for an expenditure in the neighborhood of twenty cents. The food is served in cafeteria style, the lunch period being slightly staggered in order not to overcrowd serving facilities.

The Musical Club —

This scheme was only partially successful, however. With no attraction but the lunch, many found other interests to take them elsewhere or wandered out after a hasty meal to walk the streets or find entertainment of one sort or another. At this point the employes' Musical Club was suggested and encouraged to form. Its organization was entirely in the hands of the employes themselves and the luncheon entertainments which it later furnished have been wholly under their control.

A Cabaret Lunch —

For the company lunches have transformed into a most entertaining cabaret. Admission to the musical club was limited to those with musical talent, but even with this requirement, fifty members were secured at once. These have organized an orchestra and have developed choruses and a quartet which are doing excellent work. The company has provided a piano with an electrical attachment which plays during the meal and instruments for the orchestra — drum, accordion, violin, cornet. After lunch each day a program is provided. Solos, duets, quartets, whistling accompaniments and orchestra music make up the variety of the numbers—and some astonishingly good artists have developed. Occasionally with a patriotic song, the audience joins in.

After four or five such numbers the orchestra swings into dance music and an informal dance in which all are privileged to join fills the remainder of the hour. With one o'clock the workers are back at their tasks in a pleasant frame of mind with a period of real refreshment and relaxation back of them.

As can be imagined, attendance at these meetings is very regular. Indeed, so popular have they become that even heads of departments are suspected of cutting engagements to attend. Not only has the aim of providing a wholesome occupation for the lunch period been accomplished but a new element of good fellowship and downright enjoyment has entered into the association of employes with company. The experiment is a unique one both in its details and its success—and its principle is fundamental in good business organization.

MAKING A GOOD DISPLAY OF SMALL ARTICLES IN A LARGE WINDOW

BY W. F. BRAINARD

The difficulty in making an attractive display of small articles in a window with a large floor space is often encountered. Many dealers overcome this by using a series of steps, building up towards the back of the window. In some cases a regular series of steps to be put in a window is built, and in other cases boxes of the right size are used. These steps can be covered with the cloth draperies used on the floor of the window, or if such is not available, crepe paper makes a very acceptable substitute. If crepe paper is used, it is advisable to use either black or purple, as nickel appliances show to better advantage against it. By the use of these platforms a window of irons, percolators and other small articles instead of presenting a flat appearance will prove to be a very attractive display.

RECOGNIZING OLD MASTERS

The eyes of the Roentgen rays grow keener with use. Experimentors with the X-rays are now using them to penetrate layers of over-painting on old portraits and to disclose the original contour of the paintings. Students of the old masters prophesy great results from this method of approach.

GETTING THE MONEY FOR YOUR BUSINESS

BY W. R. HERSTEIN

(Having established yourself as a person who deserves credit, the point is to get it. How to obtain loans from your jobber and your bank and what not to do with the money. A few pertinent suggestions as to what will give your banker confidence in you—and what will cause him to call in the loan. A general analysis of credit problems by the general manager of the Electric Supply Company of Memphis.—The Editor.)

Credit From the Jobber

Naturally, the first class to whom the contractor dealer turns for credit is the jobber or manufacturer. This is not necessarily because the contractor-dealer requires credit accommodation, but primarily because it is more convenient all around to ship goods "open" instead of C.O.D. or cash with order. The transition is slight, however, to the point where credit changes from convenience to accommodation, particularly where the dealer's business expands more rapidly than his capital.

Some of the Dangers

At this period it may be permissible to wander away from the immediate subject and sound a note of warning against a peril that confronts many dealers when their business momentarily ceases to expand. When a concern's business begins to fall off, its purchases likewise slacken and its accounts receivable diminish. The result of this is an ever-increasing bank account, and it is a common error to mistake this money for actual profits and treat it accordingly. The temptation then becomes irresistible to many to purchase that new and greatly desired automobile, or to "salt it down" in a piece of real estate. It is only when business revives and the misapplied capital is again needed, that the reality of the mistake becomes keenly apparent. Another peril, similar in character, confronts the small contractor on his first big job, where he collects more money than he has ever had in his life, and, with his creditors not seriously pressing him, desires to gratify his longings for things theretofore unattainable, but which cost money nevertheless, and which really take the money that his creditors later on demand and are entitled to, with the result that the bankruptcy court gets one more victim, with the usual accompaniment of more or less innocent bystanders.

Getting back to the dealer whose capital fails to take care of his increasing business, there are several courses open to him. An increasing business is usually a healthy symptom, though not always, as there are numerous ways of increasing business which are open to criticism, but which need not be discussed here. If the dealer can show that his increase is legitimate and his need for additional capital or credit is equally so, he should have no serious trouble in securing the desired assistance. The old method of "riding your creditors," while still practiced by some, is out of vogue and not considered in good taste by modern dealers. A limited amount of "riding" will be countenanced for the sake of helping a good and loyal customer, but the customer himself will gain by refraining from the practice and adopting one or another of the approved modes of financing himself.

The Trade Acceptance

Having shown himself worthy of credit, several methods of procuring it are available. First of all comes the trade acceptance. Primarily this device was intended to cover one specific transaction only, but for convenience in handling a multiplicity of invoices, many jobbers are taking trade acceptances once a month to cover the entire preceding month's billing. Strictly speaking, this is more in the nature of a promissory note, but trade custom will eventually sanction the practice to a point where settlements of this character will perform the true function of an acceptance.

By this means, an extension of 30 to 60 days on all invoices may be legitimately obtained, and the jobber will find it an easy matter to pass the burden on to his bank; thanks to the facilities now afforded by the federal reserve banking system and the extra favor with which all bankers look upon the trade acceptance. To preserve the efficacy of the acceptance, however, it should be understood that the obligation of paying promptly when due is not only legal, but moral and ethical as well, since the favor shown it now is based upon the belief that it possesses an influence stronger than that of the promissory note or open account, and if abused or found inefficient, this credit convenience will undoubtedly be withdrawn from debtors.

Getting Money From the Bank

Should both the credit voluntarily extended by jobbers and manufacturers, and that afforded by the trade acceptance be insufficient to meet the requirements of the thriving dealer, recourse may be had to his banker. Astonishingly few electrical contractors avail themselves of this resource, probably from lack of acquaintance with the real purposes for which banks are organized. Most of us thing of a bank as a place to deposit money, but a bank does not live upon its deposits; it lives upon its loans, and the most acceptable borrowers are live business enterprises, preference, of course, being given to the bank's regular customers. A depositor, carrying a satisfactory balance with a bank, can usually secure any reasonable accommodation necessary, and it is the part of wisdom for every business man, whether at present in the market for loans or not, to arrange a suitable line of credit, so that when the period does arrive for asking a loan, no time need be wasted in going through the necessary preliminaries. Ordinarily, banks expect customers to carry on deposit approximately twenty per cent of their borrowings, though there is no fixed rule as to this. Frequently borrowers carry a balance of fifty per cent, preferring to pay interest for the sake of having ample cash always on hand, and in such cases, if the balance temporarily falls to zero or if credit greater than the agreed line is asked, a glance at the customer's

"average balance" is likely to exert a favorable influence on the banker.

General Principles

It is hoped that the above suggestions may furnish ideas to the contractor-dealer which he can profitably apply to his own business. The business education, and particularly the financial training, of many electricians is altogether too limited and does not permit him to avail himself of the opportunities which surround him and which are his of right. He has been too long prone to look upon his business as an exceptional one and beyond the pale of regular enterprises. The work now being done by the several electrical societies and organizations is going far toward correcting this error, and toward convincing the contractor-dealer that he is just as much a business man as the druggist or clothier, and is as much entitled to the rights and privileges enjoyed by them; always remembering, however, that such rights and privileges entail obligations which are as binding upon him as upon anyone else. When he has learned to properly acquit himself of these obligations, many of which have been outlined above, and all of which tend to command the confidence and respect of creditors, then he will find his financial problems solved and the road open to a successful and prosperous future.

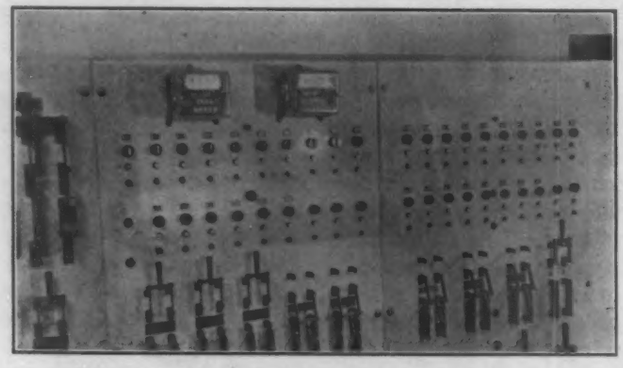
KINKS IN PRACTICAL APPLICATIONS OF ELECTRICITY

BY C. B. MERRICK

(A labor saving device worth instituting on every water front system is reported as it is in use on the piers of San Francisco. The first of a series of papers on various aspects of practical applications of electricity.—The Editor.)

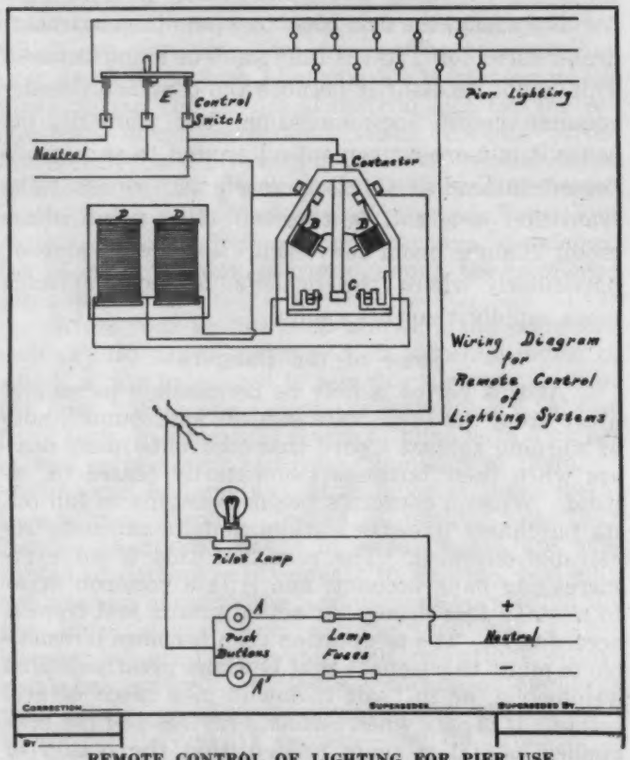
Water Front Wiring

Labor saving devices!! The importance of these words can only be approximated, in the great crisis now facing America, for every man replaced by a mechanical contrivance is 100% available for war work, and America must furnish the man power in the resonstruction work. The centralized control of water front apparatus and pier lighting for San Francisco is a striking example of how successfully



The control board is compact and simple

remote control equipment can be installed. The lighting of the 46 piers which extend along the water front for a distance of several miles is turned on or off from the office in the Ferry Building by means of a one-wire control. Merely by pressing the proper button the circuit is closed through the wire and a ground return, the solenoid switch located at the pier is operated and the lights thrown on or off as desired. The condition of the lights is then indicated on the switchboard panel in the office of Mr. C. P. Stanton, Chief Electrician of the Board of State Harbor Commissioners, by means of a pilot lamp connected directly to the pier circuit.



REMOTE CONTROL OF LIGHTING FOR PIER USE

The wiring diagram showing the details of the system. The buttons at A control the magnets at B and operate the contactor. The solenoid at D is thereupon energized and the switch at E closed, thus lighting the piers.

The photograph shows the compactness and extreme simplicity of the control board. The solenoid switch is located at the pier and is operated at will by making the correct contact for control. A schematic diagram illustrates the operation of this one-wire control equipment. Pressing the button (A) connects the magnets (B) between the positive side of the D.C. circuit and ground, and operates the contactor (C), which is a permanent magnet, to close the auxiliary circuit at (C). The solenoid (D) is thereby energized and the switch (E) is closed by the action of the plunger into the solenoid. The fact that the switch is closed and the lights burning is indicated by the pilot lamp, which burns until the switch is opened. The opening of the switch is accomplished by connecting the negative side of the supply line to the magneto, by pressing button A', thereby reversing the action as followed through above.

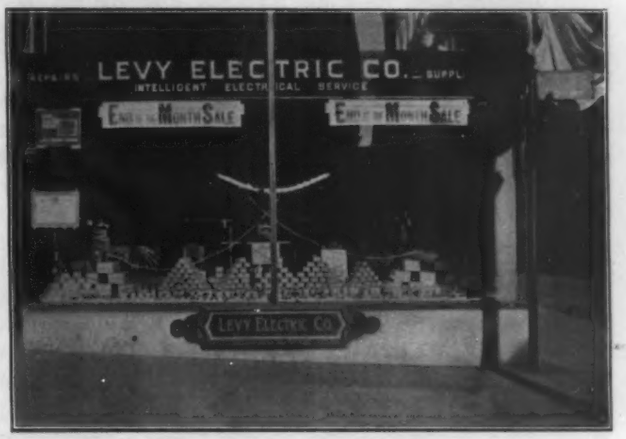
With the many demands for copper and its almost prohibitive price, even for much needed installations, a system such as this which reduces the initial cost, is of great value. This reduction in outlay permits it to be used to replace the local individual control of each pier.

Western Ideas

A SAMPLE OF REAL CO-OPERATION is illustrated by the accompanying chart. The table as shown here was featured on 5 by 15 in. cards which were issued at his own expense by H. H. Courtright, manager of the Valley Electrical Supply Company, vice-president and member of the executive committee of the California Association of Electrical Contractors and Dealers and president of the Central California Electrical Contractors and Dealers' Association. Mr. Courtright felt that this was information which the dealers should have, and in the absence of association funds for this purpose, shouldered the costs of printing and postage. The cards are without advertising and carry the Code of Ethics recently adopted by the Association and the names of the members on the back. An eyelet punched at one end offers a convenient method of keeping the card at hand for frequent reference. The process it calls for is very simple. If your cost of doing business, figured on sales, is ..... (read from left to right), and the profit at which you sell, figured on delivered cost, is ..... (read from top to bottom), your percentage of net profits is the figure at the junction of the two columns. Thus, if you figure your selling price as forty per cent above the delivered cost of your goods and you determine that your cost of doing business comes to about 20% of your sales, it is easily seen that your actual profits are 8 4/7% on sales. Aside from the practical help which this diagram may be in eliminating arithmetic from your profit figuring on any one sale, it is of considerable value as an object study. It makes very clear the fact that you may be charging thirty per cent more for your goods than they cost you and still be losing money on your business. It further suggests the necessity for figuring overhead individually for your personal business. It is not safe to accept 23 per cent or any other per cent as your cost of doing business—your expenses under adverse circumstances may run as high as thirty per cent—and the price which you figured to give a reasonable profit at a lower overhead than your own may mean that you are actually doing business at a loss.

If you haven't one of the cards in its original form, cut out the diagram shown below and paste it on a card. And then keep it at hand for constant use.

AN END OF THE MONTH SALE is an event worked out by the Levy Electric Company of Polk Street, San Francisco, as a medium for keeping up interest in this establishment. The custom is one



An end-of-the-month sale window display

which has been inaugurated by several of the local department stores and never fails to bring a crowd. Without marking down standard articles below the level of profit it is nevertheless possible to clear the shelves to a large extent of "stickers" and unprofitable goods and thus keep every atom of capital in "live" stock which has normally a satisfactory turnover. A periodical bargain sale of this sort has the advantage of not presupposing damaged or shopworn goods as its occasion. As is evident from this picture, it gives opportunity for a feature window display. But more than all, it brings the fact of the establishment's existence to the monthly attention of customers and of the neighborhood generally.

THE VALUE OF THE UNUSUAL is brought out by the success of this ingenious scheme of interesting both children and grown ups: "Recently I prepared a letter to be sent through the mail to my customers," not long ago remarked a dealer in electrical merchandise, "and while preparing that letter a plan occurred to me that, when carried out, gave me some very good publicity. After I had written the letter I crossed out a word here and there—sometimes two and three in succession, and at other times as high as six and ten. In all I crossed out about one-third of the words in the original letter. Next I had the letters typewritten with dashes to represent the words that had been crossed out. I sent those letters out with the information printed on

TABLE FOR FIGURING NET PROFITS

IF YOUR COST OF DOING BUSINESS FIGURED ON SALES IS REPRESENTED BY ONE OF THESE FIGURES

AND	%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	21%	22%	23%	24%	25%
YOU	3	7 9/10 loss	8 9/10 loss	9 9/10 loss	10 9/10 loss	11 9/10 loss	12 9/10 loss	13 9/10 loss	14 9/10 loss	15 9/10 loss	16 9/10 loss	17 9/10 loss	18 9 10 loss	19 9/19 loss	20 9/10 loss	21 9/10 loss	22 9/10 loss
MARK	5	5 1/5 loss	6 1/5 loss	7 1/5 loss	8 1/5 loss	9 1/5 loss	10 1/5 loss	11 1/5 loss	12 1/5 loss	13 1/5 loss	14 1/5 loss	15 1/5 loss	16 1/5 loss	17 1/5 loss	18 1/5 loss	19 1/5 loss	20 1/5 loss
YOUR	10	00 9/10 loss	1 9/10 loss	2 9/10 loss	3 9/10 loss	4 9/10 loss	5 9/10 loss	6 9/10 loss	7 9/10 loss	8 9/10 loss	9 9/10 loss	10 9/10 loss	11 9/10 loss	12 9/10 loss	13 9/10 loss	14 9/10 loss	15 9/10 loss
GOODS	15	3 5/11	2 5/11	1 5/11	00 5/11	00 6/11 loss	1 6/11 loss	2 6/11 loss	3 6/11 loss	4 6/11 loss	5 6/11 loss	6 6/11 loss	7 6/11 loss	8 6/11 loss	9 6/11 loss	10 6/11 loss	11 6/11 loss
AT	20	6 2/3	5 2/3	4 2/3	3 2/3	2 2/3	1 2/3	00 2/3	00 1/3 loss	1 1/3 loss	2 1/3 loss	3 1/3 loss	4 1/3 loss	5 1/3 loss	6 1/3 loss	7 1/3 loss	8 1/3 loss
ONE	25	10	9	8	7	6	5	4	3	2	1	00 loss	1 loss	2 loss	3 loss	4 loss	5 loss
OF	30	13 1/13	12 1/13	11 1/13	10 1/13	9 1/13	8 1/13	7 1/13	6 1/13	5 1/13	4 1/13	3 1/13	2 1/13	1 1/13	00 1/13	00 12/13 loss	1 12/13 loss
THESE	33 1/3	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	00
PER-	35	15 25/27	14 25/27	13 25/27	12 25/27	11 25/27	10 25/27	9 25/27	8 25/27	7 25/27	6 25/27	5 25/27	4 25/27	3 25/27	2 25/27	1 25/27	00 25/27
CENT	40	18 4/7	17 4/7	16 4/7	15 4/7	14 4/7	13 4/7	12 4/7	11 4/7	10 4/7	9 4/7	8 4/7	7 4/7	6 4/7	5 4/7	4 4/7	3 4/7
AGES	50	23 1/3	22 1/3	21 1/3	20 1/3	19 1/3	18 1/3	17 1/3	16 1/3	15 1/3	14 1/3	13 1/3	12 1/3	11 1/3	10 1/3	9 1/3	8 1/3
ABOVE	60	27 1/2	26 1/2	25 1/2	24 1/2	23 1/2	22 1/2	21 1/2	20 1/2	19 1/2	18 1/2	17 1/2	16 1/2	15 1/2	14 1/2	13 1/2	12 1/2
DELIV-	75	32 6/7	31 6/7	30 6/7	29 6/7	28 6/7	27 6/7	26 6/7	25 6/7	24 6/7	23 6/7	22 6/7	21 6/7	20 6/7	19 6/7	18 6/7	17 6/7
ERED	100	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
COST,																	

YOUR PERCENTAGE OF NET PROFITS IS REPRESENTED BY THE FIGURE AT THE JUNCTION OF THE TWO COLUMNS

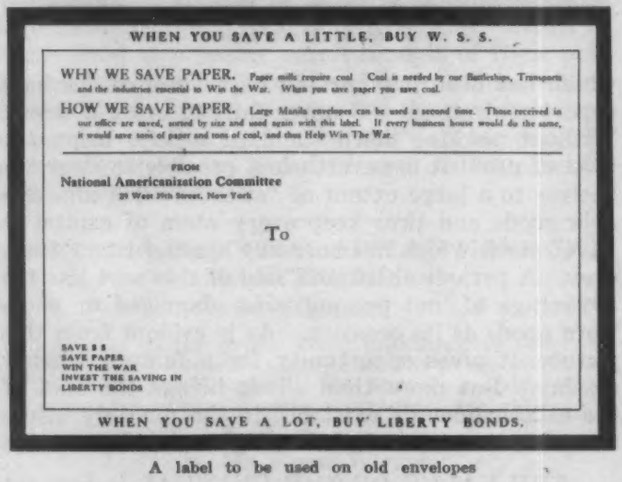
EXPLANATION—If your cost of doing business is 15% of your gross sales and you mark goods at 25% above cost, your net profit is 5% on sales—as shown in diagram. If your cost of doing business is 15% and you mark your goods at 50% above cost, your net profit is 19⅛% on sales.

This table can be used for finding the proper percentage of "mark-up" and also the net profit which the contractor is making, providing he knows his "overhead."

the back of them that the child under 16 years of age that finished the letter in the best manner would be given a prize. The plan created a lot of interest and many finished letters were returned to me. The older people also took an interest and helped the youngsters fill in the missing words. Had the letters been sent out in the ordinary way they would not have attracted anywhere near as much attention."

THE SAVING OF PAPER has come to be a national necessity. In view of the high paper costs the country over, it is something of an economy as well.

Most business organizations are called upon to mail matter in large unsealed manila envelopes—and at the same time are constantly receiving mail in this form every day. The cost of manila envelopes is very high—as much as three times greater than it was before the war, in some cases—and at the same time, the government is daily asking for a reduction of paper consumption. These facts together with the great number of untorn manila envelopes which stacked up in the waste basket of the mail clerk, suggested to the National Americanization Committee the re-use of these envelopes. The form shown in the illustration was printed in brown on manila colored paper of size about 5 by 8 in. and pasted over old envelopes for remailing. It allows space for the name of the sender as well as for the address directions. The suggestions for saving paper printed at the top are particularly effective and the appearance of the whole thing neat and attractive.


WHEN YOU SAVE A LITTLE, BUY W. S. S.

WHY WE SAVE PAPER. Paper mills require coal. Coal is needed by our Battleships, Transports and the industries essential to Win the War. When you save paper you save coal.

HOW WE SAVE PAPER. Large Manila envelopes can be used a second time. Those received in our office are saved, sorted by size and used again with this label. If every business house would do the same, it would save tons of paper and tons of coal, and thus Help Win The War.

FROM
National Americanization Committee
29 West 39th Street, New York

To

SAVE $ $
SAVE PAPER
WIN THE WAR
INVEST THE SAVING IN
LIBERTY BONDS

WHEN YOU SAVE A LOT, BUY LIBERTY BONDS.

A label to be used on old envelopes

The labels may be obtained printed at a reasonable price—or may be reproduced at will by anyone wishing to take advantage of the scheme.

MANAGING MEN is not merely a business—it is an art. Under the caption of "Ten Rules for Foremen and Others," there is published an interesting and inspiring outline for managing men which many an owner and manager might take to heart. It is in a recent number of "Going Some," the organ of the St. Johns Shipyards of the Grant Smith-Porter Ship Company, an enterprise which in two successive months secured the honor awards for wooden ship-building from the Emergency Fleet Corporation in competition with all other yards of the entire country. They are worth reading in full:

1—Be Fair.

Have no favorites and no scapegoats. A foreman has to act as judge many times every day, therefore he must be just.

2—Make Few Promises and Keep Them.

A foreman must be exact in this particular. Sometimes a foreman forgets that his job requires a high standard of truth and honor.

3—Don't Waste Anger. Use It.

Anger is the most valuable thing and should not be used carelessly. Keep your most forceful language for special occasions. Before a foreman can control others successfully he must control himself.

4—Always Hear the Other Side.

Never blame a worker until he has been given a chance to give his point of view.

5—Don't Hold Spite. Forgive.

When you have had to scold a worker, go to him later, in a friendly way. There should always be blue sky and sunshine after a storm.

6—Never Show Discouragement.

Never let yourself be beaten. A foreman must have perseverance, and never say die.

7—Notice Good Work as Well as Bad.

Mingle praise and blame. Let the workers see that you can appreciate as well as condemn.

8—Watch for Aptitude.

Take a keen human interest in your workers. Notice them. Study them. Put each one where he can do best.

9—Be an Optimist.

Don't let your worries and troubles deform you into a pessimist. Inspire confidence. Put the "righto!" spirit into the works. Say, "Come along, men, all together!"

10—Take Full Share of the Blame.

This is the most difficult of all. It is heroic. But the foreman who can share both blame and praise with his workers will have discovered the secret of managing his men.

AN ELECTRIC SIGN of an electric lamp for an electric store is the feature which calls the attention of the public to the Electric Service Company of Tacoma, Wash. The lamp serves the double purpose of pointing out the store and of advertising its ware. As plainly as if the words were printed the public is aware of the fact that electric lamps are sold within. Indeed, the words might well pass unnoticed while the sign will be recalled. It is an interesting psychological fact that most people are pictorially minded. Some will associate facts in their memories with sounds and the ocean will be recalled as the roar and swish of the waves, a train by the clicking over the rails, etc. Such people will recall information spoken orally to them more clearly than written words. The majority of people, however, have picture associations for their memories—and the more clearly such a picture has been brought out in their minds, the more likely they are to remember the store when the subject of lamps comes up. It is this fact which forms the basis of value for such effective signs as the one above as well as for window displays and display advertising.

Lamps for sale

Technical Hints

BY GEORGE A. SCHNEIDER

(A change in the safety code rulings which affects the use of switches with motors or starting compensators, a pamphlet on figuring labor costs which is worthy of careful study — and a discussion of the present situation as regards the safety of electric washing machines. Practical questions and matters of interest as they are viewed by a man in intimate touch with actual conditions.—The Editor.)

REVISED RULES FOR THE INSTALLATION OF STARTING COMPENSATORS

The 1918 edition of the National Electrical Code which has just recently been distributed contains important changes in the rules applying to the installation of starting compensators or auto-starters. In paragraph C, section 8, covering the use of switches with motors and starters, the 1915 edition of the code states that where the circuit breaking device on the motor-starting rheostat disconnects all wires of the circuit, the switch called for in this section may be omitted.

No particular reference is made to starting compensators. Therefore, this rule was generally interpreted to mean that a switch was not required on the supply side of a compensator because all wires to the motor are completely disconnected from the supply circuit by the compensator switch mechanism when it is in the "off" position. However, a little study of the connections of a typical starter will show that the starter is not completely disconnected from the supply circuit. Even with the handle in the "off" position, the fuses connected with the starter, also parts of the contacts within the starter, are alive unless there is a separate switch to completely disconnect these parts from the line. Removing the fuses does not help matters very much because even under these conditions the line contacts in the cutout and part of the contacts within the starter are still alive. Therefore, a switch connected immediately ahead of the starter is required to completely disconnect it and the fuses from the supply circuit.

It is plain from these facts that there is an element of danger connected with a starter not having a switch to completely disconnect it from the line. This point was no doubt recognized by those who had to do with the revision of the Code since the 1918 edition provides for a switch on the supply side of each auto-starter (or compensator) or group of auto-starters. This question is still covered by section 8, paragraph C, which as revised reads in part as follows:

> "Except for auto-starters, the switch called for in the preceding paragraph may be omitted where the motor starter disconnects all wires of the circuit. When auto-starters are used a switch must be provided on the supply side of each auto-starters, or group of auto-starters. When an A.C. (alternating current) starter when in in running position opens all wires of the circuit automatically under overload it may also serve as a circuit breaker."

The switch called for by this rule may be non-fusible but, of course, must have a sufficient number of poles or blades to completely disconnect all wires of the circuit. When the starter is equipped with fuses for overload protection, installations of this kind can be very conveniently and easily made by using the so-called compensator switch which is now offered by a number of manufacturers. In this device the line switch and fuses are combined in one unit. These switches are of the single throw, bottom fused, enclosed externally controlled type and are identical in construction with standard switches of a corresponding kind except that a lug is attached between the hinge jaws and upper fuse clip on each pole to receive the starting leads to the compensator.

The connections are such that the fuses are not in the circuit during the starting period, and therefore, should be of the proper size to protect the motor when running. Fuses should be selected to allow 25 per cent overload for 40 degree rated motors or 10 per cent overload for 50 degree or continuous rated motors. Fuses selected on either basis will also protect the motor against operating single phase. In ordering switches of this type, the size must be selected according to the size of the "running" fuses and not on the capacity of the "starting" or branch circuit fuses. Switches for 440-volt motors may be 500 A.C. switches whether of the compensator type or the plain non-fusible type.

This revision of the Code will not particularly affect the practice followed in those localities where installations of this character must comply with safety orders such as are outlined in the National Electric Safety Code or similar rules based thereon, since the Safety Code contains rules that provide for the disconnection of fusible cutouts before being re-fused. This particular requirement is covered by rule 324 of the National Safety Code and by Order 737 of the California Electrical Utilization Safety Orders.

When compensators are equipped with suitable relays instead of fuses for overload protection the line switch directly ahead of the compensator has generally not been required in the past, even where the special safety orders were in force. Now, however, the rules of the National Electrical Code will decide this question and accordingly a switch will be required whether fuses or relays are provided. It is hoped the next issue of National Electrical Safety Code, which is now being revised, will contain a similar recommendation.

On the other hand this revised rule will materially change the practice in those localities where switches with compensators have not been generally required to meet the rules of either of these codes.

LABOR REPORT OF NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS

Insufficient working capital, failure to allow for overhead expenses in arriving at a proper price for their work and lack of experience and errors in estimating quantity of materials and labor costs are answerable for a large portion of the financial failures among electrical contractor-dealers.

The matter of overhead charges and the various questions having to do with sufficient working capital and its conservation have been discussed fully

from time to time in the columns of the Journal of Electricity and one or two other electrical trade journals which are giving attention to the Contractor-Dealer problem. To arrive at an accurate charge for overhead requires a suitable bookkeeping and accounting system but even without this facility the contractor can pretty closely arrive at the proper percentage to be added by taking the figures given by other contractors doing about the same volume of business and class of work. Likewise one can get suitable instructions on the handling of financial matters from many sources. The question of estimating labor costs, however, is somewhat more complicated. In its final analysis it will always be the personal judgment of the estimator based upon his own actual experience although of course much can be gained by an interchange of ideas and figures on this subject with others. However, the number of articles which have been published on the methods of estimating are small compared with those on overhead charges. Also very few articles contain figures taken from actual practice.

The very best study on labor costs that has come to the writer's attention is that given in the Report on Labor Data compiled by the Electrical Estimators' Association of Electrical Contractors and Dealers held at Cleveland, in July. This report has recently been distributed to members of the association for insertion in their well-known Universal Data and Sales Book.

The report includes a brief statement of several factors entering into an estimate and describes a method of proving quantities for lighting tap circuits. But in any case they will be found useful. Figures showing the size of switch and fuses would add considerable to the usefulness of these tables.

This report well indicates the class of constructive work being done by this association and is well worth careful study by those interested in estimates of this character. It contains just the information many contractors and especially the smaller ones have always needed. While the figures of course will not be applicable where the labor rate differs from Chicago, the time studies given will be found of value in any territory. Further papers and studies of this character are needed. It is hoped they will be published frequently.

MAKING THE ELECTRIC WASHING MACHINE SAFE

An objection often registered against the electrically operated washing machine is, that it is dangerous. The extent to which this idea is prevalent in the minds of the general public is brought out forcibly by the number of times this question is asked when the purchase of a washing machine is being considered. Few women overlook this point, and it is one that requires careful and accurate explanation on the part of sales people.

In this respect, the electrically operated washing machine is not different from any other of the popular electrical devices used in the home.

There is, of course, some likelihood of receiving shocks from most of them, depending upon their construction and conditions under which they are used. However, the washing machine is very likely to be operated under just the conditions that are favorable for shocks; so there is really some ground for this feeling, for every once in a while reports of this kind are received. Even though there is not an actual physical injury, and this is usually the case, the accident is rarely forgotten and unfortunately is too frequently related to neighbors and friends.

These shocks are more common during damp weather or when the machine is used in a laundry room filled with steam. The shock results from a film of moisture forming over the brush insulators or similar parts which allows a leakage to the motor frame and its supporting parts. As all metal parts of the machine are usually mounted on wooden legs, which insulates them from the ground, the operator of the machine may receive a shock when the hands are immersed in the water. Complaints of this kind have been received even when the motor frame is completely insulated from the other metal parts of the washer and when the so-called enclosed type washing machine motor has been employed.

One of the large distributors of washing machines, through its inspection department, has recently completed a careful investigation of the possible schemes of grounding the motor to remove the cause of the trouble. Further investigations are being conducted by the manufacturer of the motors used on this particular machine.

Until some more effective method is found for overcoming this difficulty, this particular distributor has decided to ground the motor frame by means of a copper wire imbedded in one leg of the washer and connected on one end to the motor frame and on the other end to the castor on the bottom of the leg. This change it is believed will, to a certain extent, remove the trouble.

This method will, of course, not eliminate the shocks if the machine is mounted on a wooden platform and the operator stands on a damp or wet floor. However, the scheme is a step in the right direction and will without doubt help to a considerable extent to eliminate the trouble and its attendant results. While there is some possibility of receiving shocks from leakage at the motor, there is an almost equal opportunity for shocks when switches are mounted on the body of the washer. Some manufacturers follow the practice of furnishing a switch mounted in this way, while others do not. The washer without a switch is without doubt best from the safety standpoint.

SUBSTITUTE FOR TAPE

Resourcefulness was shown by a certain Middle Western electrical repair shop which was obliged to find a temporary substitute for a shipment of cotton tape which had been held up. The men rolled a bolt of white cotton cloth on a half-inch dowel, marked off the various widths and cut the cloth into tape with a band saw. To prevent unraveling at the edges, a heavy coat of shellac was applied and the alcohol burned off before it dried. The semi-baking effect produced strengthened the tape and prevented it from curling.

CONTINUOUS RATING OF MOTORS

(The article on 50 Degree Motor Ratings which appeared on page 509 in the May 15th issue of the Journal of Electricity created so much interest and brought forth so many questions that one of the manufacturers of these motors has found it advisable to prepare a general statement for the benefit of customers and salesmen, setting forth the characteristics of these new motors, the reasons for their adoption, hints as to their selection and application and a discussion of their general merits. This is here given in the form of questions and answers for the convenience of those handling these motors.—The Editor.)

Q. Wherein does the "continuous rating" of general purpose motors differ from the preceding method of rating?

A. Previously general purpose open motors have been designed on the basis of temperature rise of 40 deg. C. for full load continuous operation, and with a temperature rise of 55 deg. C. after two hours continuous operation at 25 % overload. Successful operation was also guaranteed under a 50% momentary overload. The ambient temperature or temperature of reference was 25% C.

The new line of Continuous Rated general purpose motors has been designed on the basis of a temperature rise of 50 deg. C. for full load continuous operation, without overload and temperature guarantees other than successful operation at 50% momentary overload. The ambient temperature or temperature of reference being 40 deg. C. The new method of continuously rating general purpose motors is in accordance with the Standardization Rules of the A. I. E. E. with regard to heating and overloads. These standardization rules have been accepted by the Electric Power Club.

Note: The A. I. E. E. represents all branches of the electrical industry, one of its principal functions being to establish technical standards. The Electric Power Club, an organization confined to manufacturers of electrical apparatus, has also for a leading purpose the standardization of apparatus employed in the industry.

Q. What heating standards has the A. I. E. E. established as applied to general purpose motors?

A. (1) The standard ambient temperature of reference for air which shall be 40 deg. C. (A. I. E. E. Standardization Rules, Sec. 305.)

(2) The permissible temperatures and temperature rises for treated fibrous insulating materials. The maximum temperature to which such materials may be subjected shall be 105 deg. C. The maximum temperature rise shall not exceed 65 deg. C. (A. I. E. E. Standardization Rules, Sec. 377—Table III, Class A.)

(3) The permissible hottest-spot temperature and limiting observable temperature rise in air-cooled electrical machinery shall be as follows:—

The permissible hottest-spot temperature shall be 105 deg. C.

The hottest-spot correction shall be 15 deg. C. for open motors. (When the supposed actual hottest-spot is inaccessible for temperature measurement, it shall be deemed to be 15 deg. higher in temperature than the nearest spot at which temperature can be observed.)

The maximum observable temperature shall be 90 deg. C.

The observable temperature rise shall be 50 deg. C. for open motors. (A. I. E. E. Standardization Rules, Sec. 379—Table IV—Method I.)

This temperature rise has been accepted as applying to a motor so constructed as to allow circulation of air between the inside and outside of its case or frame. In an enclosed motor the maximum observable temperature and temperature rise shall be taken as 5 deg. higher. This is in recognition of a lesser difference between the hottest-spot and the observable temperature within an enclosed motor. (A. I. E. E. Standard Rules—Sec. 386-A.) All temperature measurements are to be made by thermometer in accordance with A. I. E. E. Standardization Rules, Sections 314-317, inc.

Q. Why was temperature of 105 deg. C. selected as the maximum permissible limit for treated fibrous materials?

A. Because the A. I. E. E. determined from careful investigation, supported by tests and the results of practical experience, that this value was well below the critical point at which treated fibrous insulation begins to appreciably deteriorate and that 105 deg. C. was therefore a conservative, maximum permissible limit.

Q. Will treated fibrous insulation when subjected to a lower temperature have a longer life?

A. Experience indicates a negative answer. The A. I. E. E. states in its Standardization Rules, Section 302, page 31:—

"There does not appear to be any advantage in operation at a lower temperature than safe limits, so far as life of the insulation is concerned."

Q. Why was an ambient temperature of 40 deg. C. chosen rather than the temperature of 25 deg. C. formerly used?

The reason is well given in the following quotation from British Standardization Rules for Electrical machinery:

"The life of a machine depends in great measure on the maximum temperature to which the insulation is exposed. This maximum temperature depends on the output the machine is giving and on the temperature of the air or other cooling medium. For the purpose of establishing the permissible temperature rise in a standard machine, so as never to exceed the limits permissible for the total temperature, it is necessary to consider not the **average** but the **maximum** temperature to which the cooling air may rise in service. Numerous records have been examined and 40 deg. C. has been selected as the most suitable value to be adopted as the maximum temperature of the cooling air for nearly all climates."

Q. Where the ambient temperature exceeds 40 deg. C. what precaution should be taken in recommending and applying general purpose motors?

A. It is recognized that there may be unusual conditions where the ambient temperature of 40 deg. C. may be exceeded, but such cases are exceptions, and should be so treated. Standard general purpose motors should never be sold where it is known that they exceed 40 deg. C. (104 deg. F.), but special quotations should be requested on motors designed to meet the requirements of each case where motors are to operate in abnormal ambient temperature.

Q. Will the insulation in motors guaranteed for 40 deg. C. rise have a longer life than the insulation in motors guaranteed for 50 deg. C. rise, assuming the character of the insulation to be the same?

A. No, because the ultimate temperature at which motors may be operated as determined by the A. I. E. E. is well within the limit of safe operation, or that in which there is no appreciable deterioration of the insulation. The deterioration of insulation in a motor may be compared with the melting of ice, as follows:

As long as the temperature of ice is kept below melting point, it will not melt. Likewise, insulation will not deteriorate until the critical point of temperature is reached.

Q. Will the change from 40 deg. C. to 50 deg. C. rise allow a motor to be rated at a greater output?

A. Yes. The continuous output of a 40 deg. C. rise motor could theoretically be increased approximately 12% assuming that it was permissible to increase the temperature rise to 50 deg. C.

The Electric Power Club has standardized load ratings for general purpose motors. In sizes below 20 h.p. the increase in standard load ratings from a lower to the next higher rating is disproportionate to the increase in output which would be permissible on the basis of a 10 deg. increase in temperature rise. For example,

The increase from 1 to 2 h.p. is 100%.
The increase from 5 to 7½ h.p. is 50%.
The increase from 15 to 20 h.p. is 33 1/3%.

Inasmuch as motor manufacturers are committed to the standards adopted by the Electric Power Club it is necessary to make mechanical changes in a number of sizes to obtain the Standard Load Ratings. In the case of many large size D.C. motors the per cent increase from a lower to the next higher load rating more nearly approaches the allowable increase in output permitted by increased temperature rise. Hence such motors could be rated up with little change. An important factor in the rating up of motors is the full load operating temperature of the motor to be rerated. If the temperature rise was materially below 40 deg. C. advantage could be taken of this fact, provided electrical or mechanical limitations were not encountered.

CALIFORNIA ELECTRICAL CO-OPERATIVE CAMPAIGN TAKEN TO THE NORTHWEST

(The California Cooperative Campaign as it was presented to the electrical men of the Northwest at the recent convention in Portland.—The Editor.)

At the recent one-day session of the Northwest Electric Light and Power Association in Portland, the chairman of the meeting, Mr. O. B. Coldwell, superintendent of the Portland Railway Light and Power Company, called upon Robert Sibley, Editor of the Journal of Electricity, to tell the men of the Northwest something of the electrical activities in California. As taken down in the stenographic reports of the convention, Mr. Sibley's address was as follows:

"I have been particularly interested this morning in hearing the remarkable address of your president as to the present utility situation in the Northwest, and also this afternoon in hearing the brief outline of the proposed system of cooperation in electrical matters in this section.

Now, in my opinion, the question of getting into some cooperation, both among all the branches of the electrical industry and the public generally, is the real problem that faces this association and every association of electrical interests today. I will take but a minute to tell you something that has been done along that line in California.

We feel this problem is one of such vital interest there that we have actually raised the sum of twelve thousand dollars, which has been contributed to by the jobbers, by the central station men, by the manufacturers and by the contractor-dealers. This twelve thousand dollars is being devoted exclusively to educational campaigns in that section. We have employed two field men, whose sole duty is to go about the state preaching the gospel of cooperation, and the results they are obtaining are simply wonderful. You would be surprised to see the splendid spirit of cooperation which is being engendered among the members of the industry, and also the forming of a renewed public opinion favorable to the public utility life.

I might state this is doing a wonderful thing throughout the industry itself. There are big mass meetings being held. First in Los Angeles last March I attended a meeting where over three hundred men in the industry were gathered from all over the southern district of California to attend this meeting, where men actually talked this problem of how to educate the public on the necessity of raising rates and in getting the water power situation straightened out, and in getting the proper system of taxation so as to stop the strife and struggle between the contractor-dealer and central station. A meeting in Central California was held in San Francisco, which I had the pleasure of attending in June. At that meeting over four hundred were in attendance at the Commercial Club rooms one evening. These meetings are always preceded by a great deal of good fellowship that is being engendered in these times, and there is something more than actual discussion of problems. By the very nature of things this spirit of good fellowship is engendered when sitting around the table together. When you have once sat at the table with a man you wont go out and cut his throat quite as easily as you would the day before. To aid in developing this spirit of good fellowship community singing has been instituted. You would not think this would be anything that would help to solve technical problems, but we have found, as a matter of fact, that the institution of community singing —all of this idea has come about in the soldier's welfare work—has done a great thing to us in California.

Following the meeting in San Francisco a meeting was held across the bay in Oakland where we had over a hundred men, and now they are planning next month to even go one step further and stop actually talking cooperation and to get down to specific results in Los Angeles. Perhaps you know we have had a great deal of trouble down there over the question of priorities of service, which is a vital problem today, as to whether certain extensions to power service should be made at all. Down in Los Angeles next month there is to be another mass meeting to tackle this problem, and not only the central station will be there, but there will will be representatives of the contractor-dealers, the jobbers, manufacturers and electrical contractor-dealers, and a number of public spirited men who are interested in these public problems. (The papers of this splendid meeting were published in full in the Journal of Electricity Nov. 1, 1918.)

I heard the report of your secretary and treasurer this morning in which it was stated that you had something like three thousand dollars in your treasury. I don't believe you could devote that money to better advantage—in fact, go out and raise another three thousand and make it six thousand—to put across a cooperative campaign throughout the Northwest and actually get down to results, and you will be surprised how the public will change their minds on some of these things that they have a different view on."

AN ELECTRICAL STEEL FOUNDRY

BY F. D. WEBER

(One of the many industrial uses to which electricity is being put—and an instance of how it is fitting into the national program. The details of the installation and its costs. The author is electrical engineer for the Oregon Insurance Rating Bureau and Portland representative of the Journal of Electricity.—The Editor.)

Conservation of steel is being accomplished by utilizing the steel clippings and punchings from the steel shipyards by means of the electric furnace. This is being done by the Electric Steel Foundry, Portland, Oregon, who manufacture mild steel castings, principally for ship building construction.

The company was organized five years ago, and commenced operations with a single phase Gerod

THE PLANT OF THE ELECTRIC STEEL FOUNDRY CO.
Steel clippings and punchings from the steel shipyards are here recast by the use of an electric furnace

type of furnace with a capacity of one to two and a half tons per day. This furnace was hand operated. A new furnace just completed is also a Gerod type of single phase furnace, embodying every new feature which the company deemed necessary to make it the most modern installation on the Pacific Coast. The electrodes are equipped with Thury regulators made by Volta Mfg. Co. They are controlled also by hand power by means of two geared emergency hoists, which are thrown in by means of a clutch.

The two electrode motors are equipped with magnetic brakes and are 1 h.p. three-phase, 120 volts. The tilting mechanism is also operated by means of a 3 h.p., 3-phase, 120 volt ind. motor. This mechanism consists primarily of a worm gear reduction mechanism with a gear ratio of 1140 to .83, direct connected by means of a pinion on the motor. Electric power is obtained from the Portland Railway, Light and Power Company, at 11,000 volts, single phase, sixty cycles, and transformed to 75 volts and 8,000 amperes (max.). Protection to the plant is obtained by the use of remote control single throw oil circuit breakers, rated at 12,000 volts and 300 amperes. They are also equipped with an inverse time relay, set for 40% overload for 45 seconds.

The primary side of the transformers may be disconnected by means of a 13,000 volt, 100 ampere disconnecting switch, and the secondary by switches in the transformer vault. The transformers for this installation are placed inside of a well ventilated, reinforced concrete transformer vault, which is con-

THE FURNACE
Five years ago the plant started with a single phase furnace of the Gerod type. A new furnace with all modern features has just been installed.

nected under ground to the base of the furnace by means of a reinforced concrete tunnel or subway. The copper bus bars are racked in this tunnel and extend from the transformers to the furnace, a distance of 45 feet, and have sufficient cross-section to carry 8000 amperes, on a basis of 1000 amperes per square inch of cross-section.

No special means is used to cool the electrodes.

Near the furnace there is installed a slate switchboard having mounted on it the following apparatus:

1 S.M.Voltmeter, for reading voltage across the arc.
1 S.M. Ammeter for reading the current on the primary side of the transformers.
1 S.I. Single Phase Power Factor meter in order to estimate the power consumption at any time.
1 Type C indicating watt-hour meter.
1 Relay Type Graphic Wattmeter.
1 Inverse Time Element overload relay.
1 Hand control remote operated circuit breaker mechanism.
2 Current transformers, one for the circuit breaker and one for the instruments.
1 Potential transformer for the meters.
1 Thury Regulator.

The approximate cost of the new installation was $20,000 and it requires approximately 600 kw-hr. per ton of steel melted.

HIRING A SALESMAN WHO DOES NOT WORK

If you hired a salesman who did not make any sales, you would be losing money if you continued to pay his salary, according to the Hardware Age. How about your show windows? You are paying for the use of them, and if you are not making them sell goods for you, you are depriving your business of much of its profits.

One of the arts of displaying merchandise in a window is to arrange it so that the display will get more than one glance from the passer-by. Out of all the windows that line your business street, how many are so made up that they will arrest a person's attention? Why not make your window different?

RELATIONS BETWEEN UNITED STATES AND JAPAN

BY J. R. GEARY

(The development of Pacific trade for the United States means largely the development of rivalry or co-operation with Japan—whose growing business interests touch ours at almost every point. That this is to be a perfectly friendly cooperation is the cheerful message of these extracts from a talk given before the San Francisco Electrical Development League. The author speaks with the authority of many years experience as representative of the General Electric Company in Japan.—The Editor.)

German Propaganda

A great deal has been written and discussed with regard to the relations between Japan and the United States. Certain misunderstandings have existed in this country with respect to the intentions and policies of Japan, which misunderstandings I feel quite confident have been caused, to a very large extent, by misrepresentations and German propaganda in the United States previous to and during the present war. We know very well that an effort was made by Germany to cause trouble between Mexico and Japan. Public statements have been made by the representatives of Germany that they openly intended to cause such trouble if possible to do so. I personally have made a good deal of investigation and have spent considerable time in investigating statements made in this country detrimental to the integrity and policies of Japan with regard to the United States, and I am able to state that, without question, a great deal of such impressions is a direct result of efforts made in that direction by people who have been apparently interested in the extensive campaign of Germany with respect to its aims for world power which brought on the present war.

A representative of the German government, who lived for some time a short distance from my residence in Yokohama, came to New York when war was declared between Japan and Germany. This man had considerable to do with the passport frauds which were investigated and exposed by our Administration at the time. Quite recently it has been shown in the investigations which have taken place regarding the purchase of the New York Evening Telegram by Dr. Rumley that this same man, formerly a representative of the German government in Japan and later enjoying the hospitalities of this country, was one of the principal figures concerned in the negotiations whereby money from the German government was supplied to consummate the purchase of that New York newspaper so that it might be published favorable to the enemy country.

It has also been proved quite recently in these investigations that the proprietor of a certain group of newspapers in this country was for a long time very friendly and received visits at his house in New York of direct representatives of the German government. This group of newspapers has, in my opinion, done a great deal to endeavor to strain the relations between Japan and the United States.

Friendly Relations

I wish to state that during my fifteen years of residence in Japan I have had a very large acquaintance with prominent Japanese who have been and are using every effort to increase the friendly relations between the two countries. I have heard such persons talk, not only at public functions, but privately, where sincere expressions and feelings have been shown as to their opinions on these matters. I can state without question that there has always existed, on the part of the most important statesmen and representative people in Japan, a sentimental feeling towards America and Americans. This has existed perhaps to a greater extent in relation to America than any other country, because the Japanese appreciate that America first introduced Japan to the other nations of the world by the opening up of that country by Commodore Perry in 1855, when he was sent to Japan by the President of the United States at that time to negotiate a treaty of navigation and commerce. The Japanese appreciate what they have learned in an industrial way from the United States by the welcome and hospitality always extended to Japanese engineers and business men when they visit our country. No people that I know of are more appreciative of favors granted them than the Japanese people and I believe that it would be impossible to bring about any serious differences between the two countries, notwithstanding the temporary injury which has been done by the propaganda and wrong statements which I have mentioned above.

At the present time these things are perhaps better understood by the officials of Japan and the officials of our own government at Washington than ever before and I believe, from recent investigations and facts which I have obtained, that there is really a better feeling and a better understanding between the two countries at the present time than has existed for the past few years. This has been brought about, to a considerable extent, by the ability, frankness and high statesmanship of Viscount Ishii, the present Japanese Ambassador at Washington, and the representatives of our own State Department there.

Commerce Exchange

There can be no serious differences between Japan and the United States—the two countries are so concerned with each other. We buy from Japan practically all of her silk, her tea, her porcelains, and many other items manufactured in that country. Japan takes from us large quantities of raw cotton whereby the large cotton mills of Japan are kept in operation. She buys from us large quantities of machinery and all kinds of steel products and raw products of a great variety to be used in her manufacturing establishments which are extending so rapidly. It is only common sense, therefore, in considering the situation from all points of view, that the relations between Japan and America should increase in sympathy and respect for each other.

Japan welcomes the cooperation of American business men in the manufacturing and other enterprises of that country. The Japanese are willing to go into cooperative enterprises, holding the majority themselves, or giving the majority to Americans, or each holding a 50 per cent interest—whichever may seem most desirable in discussing such business propositions. This same cooperative spirit is welcome to Japanese with regard to American capital going in with them in enterprises in China. In this connection also it is only natural that the Japanese would welcome such cooperation because they know of the progressive development of industrial concerns in the United States and the great capital which exists in this country to operate on a large scale. The Japanese are constantly learning from us the lines of business and technical principles which are being taken up in Japan, consequently it would not be reasonable to believe that there would be any other desire than cooperation in extending to Japan the knowledge and business ideas which have been so clearly developed in this country.

Japan and China

Much has also been said with respect to the relations of Japan and China. There have been in the past varying policies pursued on the part of the Japanese officials with regard to the activity of Japan in China. Lately, within the last few years, the present Ministry has publicly announced very clearly the final fixed policy of the Japanese Government with reference to political and industrial activities in China. Such policy is friendly industrial cooperation rather than a too active political policy. Japan appreciates that the opening up of China and the increase in its industrial business will enable Japan to obtain more and more business in that country. Japan also realizes, as has been shown by this later commercial policy, that Japanese investments in Chinese industrial institutions will assist them in coming closer to the Chinese people. To prove that this policy is actually being carried out it is only necessary to refer to the Japanese investments in China. This does not mean in any way that the United States is to be prevented from making investments and increasing their commercial activities in China. The Japanese are ready to welcome any investments or action in China which will increase the commercial activity of that country because it is appreciated that such increase in the commercial activity will enable Japan to ultimately and quickly obtain its proper share of such increase. Japan would welcome, as stated above, the cooperation of Americans in such enterprises, but it does not in any sense consider that that is the only manner in which American interests in China may be increased.

Such matters in reference to China will surely prove to be true in the same manner as the actual things which have happened in Korea. Before Korea was taken over by the Japanese we foreigners in Japan, representing American manufacturers, could obtain but very little business there because of the unsettled political situation and the inactivity of the Koreans. Since Japan took over that country we have all been able to do a considerably greater amount of business there, which is constantly increasing, and it is done on a basis which is satisfactory to all concerned.

Japan in the Present War

With regard to the position of Japan with reference to the present war, I think it is well known that Japan has been ready from the beginning to assist in every way that it has been possible. There have been various statements made as to Japan sending an army to Europe, but quite definite opinions have been advanced by important and experienced people, both in Japan, America and other countries, that it might be quite impossible for Japan to send a large number of soldiers to Europe and maintain them there in fighting condition. It might require, probably, the service of such a large part of the shipping of Japan that it would have seriously interfered with and embarrassed the business relations between Japan and the United States and other countries, to the serious detriment of not only Japan but to the other allied countries. Japan has been ready to cooperate in Siberia with the other allied nations in any manner which was considered by all to be for the best interests of all the allied nations. I believe that the plan finally worked out in Washington, by our Administration, Viscount Ishii (the Japanese Ambassador), and other Allied nations and which is now going into effect in the Siberian campaign, to be proper, and I feel perfectly sure that Japan has assisted in every possible way to bring about this satisfactory result.

I have heard, at public meetings in Japan where a large attendance of Japanese and Americans were present, Japanese statesmen very close to the Government enunciate the same principles with respect to this war that we ourselves do in this country and state as strongly as we state, the inhuman actions of the Germans in the conduct of the present war. The Japanese are in entire accord with the policy and principle on account of which America is engaged in the present war, and I know very well and feel sure that Japan is as loyal to the cause and will stand shoulder to shoulder with the United States and the other allied nations until the war is won by the allied nations.

PROGRESS OF ELECTRO-CHEMICAL INDUSTRY IN JAPAN

The first appearance of electro-chemical industry in Japan dates as far back as 1889. The total power consumed by the electro-chemical industry, however, made a meager showing of only 28,000 kw. before the war. The outbreak of the war had a tremendous effect upon this type of industry due to the wonderful advance in prices of chemicals. The total power utilized in this industry became 57,000 kw. at the end of August, 1916, and in August of 1917 it increased to more than 89,000 kw. Adding to this the plants under construction the total power at work and under contemplation at present is 485,000 kw.

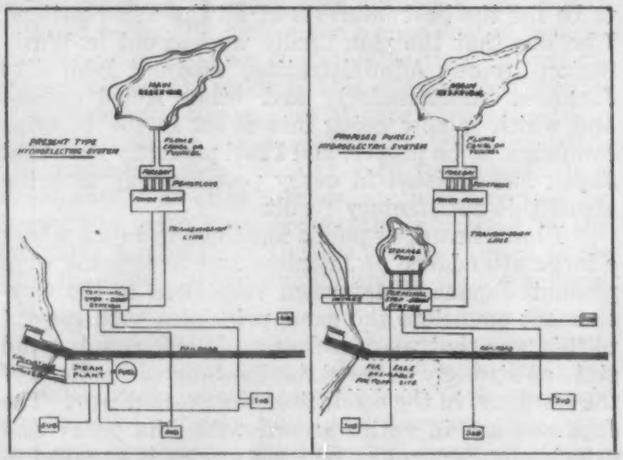
The products before the war were restricted to electro-copper, calcium carbide, nitric fertilizer, and potassium chloride. At present the following may be added to the above lists: zinc, ferro-alloys, special steel, phosphorus, caustic soda and sodium peroxide. Even cast iron and nitric acid are under contemplation.

SYNCHRONOUS CONDENSER IN FUEL CONSERVATION

BY L. N. ROBINSON

(To attain the eighty million barrels of fuel oil for the propulsion of our new merchant marine vast conservation of power is necessary. Here is constructive suggestion by an instructor in electrical engineering at the University of California, that offers a wide field of possibility in attaining a saving on a gigantic scale.—The Editor.)

In past hydroelectric developments for general power purposes, it has been customary to construct reserve fuel consuming electric generating plants of proportions varying with the character of the expected load. If this plan is to be followed in the current developments, it is clear that any enlargement of hydroelectric capacity presupposes a proportional extension of the demands for fuel in this industry rather than the contrary, simply because of the inherent economic characteristics of the two types of electric generating plants. Consequently, if hydroelectric power is to be developed primarily for the purpose of conserving fuel, a careful study should be made of every possible means of eliminating the use of fuel as an auxiliary thereto in order



The relative location and connection of the more important parts of the present type of hydroelectric system and of the proposed purely hydroelectric system using storage pond and synchronous condenser.

that the primary source of energy may be developed to its utmost of utility as well as of economy. It is my purpose to point out briefly one direction in which relief from the situation may be afforded.

Between the Water Shed and the Distributing System —

Let us consider the anatomy, so to speak, of an hydroelectric system. In general, the modern system has, between the watershed and the distribution feeders, the following important parts:

1. Storage reservoir, usually involving large areas of land and extensive dam construction.
2. Canal, tunnel, flume or other water conductors.
3. Forebay or header.
4. Penstocks.
5. Power house and allied buildings.
6. Hydraulic motors and their control equipment.
7. Electric generators and their control equipment.
8. Transformers and line switching equipment at the power house.
9. Transmission and communcation lines.
10. Transmission switching stations and their equipment.
11. Terminal step-down station building.
12. Terminal step-down equipment.
13. Synchronous condensers for voltage and power factor control.
14. Steam power plant buildings.
15. Boilers, fuel handling machinery and auxiliary equipment.
16. Steam driven prime movers with condensers, pumps, piping and control equipment.
17. Steam plant electric generators and their control equipment.

Now, is it possible that any of the above equipment can be made to serve more than its original single purpose so as to eliminate other equipment and at the same time reduce the consumption of fuel? It is readily seen that all the items down to, and including No. 13, are practically essential in any hydroelectric development.

The Steam Plant and Its Function —

On the other hand, the steam plant has been deemed essential mainly to carry the daily and seasonal peaks because it inherently shows the greater economy in cases where the load factor is low. Unquestionably, the hydroelectric system is the more economical if the load factor is high. Another reason for the retention of fuel consuming electric generating stations is for standby in case of emergency. Hydroelectric power houses are quite frequently connected to their main load centers by long transmission lines having comparatively few circuits. Consequently, a breakdown on one circuit produces a serious inconvenience, and to have all the circuits down may mean a catastrophe unless generating stations, located near the load centers, are always ready to pick up the load on fairly short notice. The third reason for the construction of steam plants is the contingency that they may be called upon to carry the system for extended periods in abnormally dry seasons like the one that has just passed on the Pacific Coast. It is thus seen that the steam plant fulfills three important functions that must be performed by any plant that is intended to replace it.

Discussion of Hydroelectric System Parts —

Returning to the physical hydroelectric system, the first item, water storage facilities, is of prime importance, particularly in western developments where the precipitation is concentrated in a few months of the year. Water storage usually entails a large investment in dams and reservoirs. In the mountains, the land is not usually priced so highly that the cost to acquire it seriously interferes with the development. But if the reservoir infringes upon Government land, under the present regulations, this fact may entirely alter the character and desirability of the site and perhaps of the whole project. Also, reservoir sites for hydroelectric developments are frequently in inaccessible locations so that it becomes necessary to build roads or even railroads in order to transport the materials for the construction of the dam and headworks. For these and other reasons, it would be convenient to be able

to locate at least a part of the reservoir capacity irrespective of the location of the watershed.

None of the items from No. 2 to No. 12 can well be dispensed with or rearranged so far as can be seen at present. On the other hand, Item No. 13, synchronous condensers, is one which has only been demanded by the comparatively recent introduction of high voltage transmission. These machines are neither energy producing nor converting, but are required merely for purposes of regulation. As such they are quite expensive to install and the energy irretrievably lost through their operation is not inconsiderable. The magnitude of the synchronous condenser installation on very high voltage transmissions may perhaps be realized from the example of one modern line which, when put into operation, had an installed power house generating capacity of 64,000 kw. while its condenser equipment at the main step-down station was rated at 30,000 kv-a. In fact, the two synchronous condensers were practically duplicates of the four generating units at the power houses.

Condensers as Prime Movers —

Obviously, if the condensers just referred to could have been provided with prime movers, a load nearly equal to the half of the installed hydroelectric generating capacity of the system could have been picked up at the load end of the transmission line in case of necessity; in other words, the equivalent steam plant capacity could have been replaced. Moreover, if these condensers could operate as motors to store off-peak energy and as generators to contribute peak energy, the power house and transmission line might operate at practically constant, **maximum efficiency** load, thus largely removing the necessity of artificial line regulation, not to mention the revenue accruing from ability to furnish peak energy.

It is interesting and important to observe a feature that exists with given line regulation requirements and suitable condensers at the terminal step-down station. Due to the quadrature phase relation of energy and wattless components of current, a synchronous condenser can deliver wattless current corresponding to 10,000 kv-a. and simultaneously absorb as a motor or deliver as a generator 10,000 kw. with a total current corresponding to only approximately 14,100 kv-a. In other words, if 88 per cent of the rated capacity is represented by wattless current and 88 per cent by energy current, the resultant current is within the 25 per cent overload capacity of the condenser. Herein, then, lies a possibility of securing considerable additional duty from synchronous condensers of which advantage should be taken wherever feasible.

When synchronous condensers were first employed, their purpose was frequently served by manipulation of the fields of the synchronous converters which were already installed for handling the railway load. This arrangement was usually not satisfactory because of the mutual interference of the two functions of the machines. With the proposed system, however, there need not be this interference because the load on the condensers will not be of a fluctuating character like that of a converter supplying a railway load.

Storage of Energy by Pumping —

In high voltage transmission projects, there seldom exist any severe limitations as to the location of the terminal step-down station further than that it must be within a radius of a few miles from the load center. It is also quite frequently the case that the community which affords the main load center of the system is located on a waterway or on the seaboard. That is, the terminal step-down station may usually be located near an abundant supply of water. Furthermore, near most large communities there are suitable sites for reservoir development. Given these natural prerequisites and the station conveniently located, it remains to couple reversible hydraulic turbines to the synchronous condenser equipment and to install the necessary hydraulic control machinery, piping and penstocks, in order to provide a storage plant capacity sufficient to replace the usual steam plant.

To suggest pumping water for hydroelectric development perhaps appears somewhat of an anomaly. But an attempt in this direction was made last season when the Sierra and San Francisco Power Company absorbed off-peak energy of the Great Western Power Company and delivered peak energy in return with a suitable differential for the accommodation. While this arrangement may have been satisfactory in the instance cited, it will probably be more economical in the long run if the inter-company exchange can be avoided. As another example of the storage of energy by mechanical means we have the regenerative braking of trunk line trains which has proved so eminently practical and economical in the most modern mountain electrification.

Modifications of Machines Necessary —

As in every new development of large proportions, some modifications of machines will be necessary. In order to produce the reversible turbines some not insurmountable problems of design will be involved. On the electrical side, suitable machines and appliances can be had with a minimum of preliminary development. Technical details must follow from the economic and other considerations in each individual case. For instance, the size of the storage reservoir will be determined by the load that it is intended the terminal plant shall carry and by the duration of the load.

Inevitably, any system of energy conversion involves losses, but it is undoubtedly safe to say that, all things considered, the overall efficiency of the proposed type of storage plant will be well above fifty per cent. The energy losses of the condensers will be present under any circumstances so they should be omitted from the comparison. The improvement in the power house, transformer and line efficiencies due to operation close to constant load, for which the system may be designed to render maximum efficiency, must be credited when the losses in the turbines, piping, etc., are debited. Also, as mentioned above, the operation of the line at nearly constant load minimizes the amount of watt-

less current that must be handled, and this is always desirable.

The Problem is to Balance the Costs —

As to the initial investment, the problem becomes one of balancing the cost of the reservoir site, dam, piping turbines and auxiliaries of the proposed plant, against that of the equivalent steam plant taken together with whatever pondage or storage reservoir construction in remote regions may be avoided by the adoption of the new system.

As to operating costs, the ordinary step-down station must operate with a full crew twenty-four hours per day. To operate the proposed type of plant would generally require only one or possibly two additional men per shift. Compared with that required for the operation of an equivalent steam plant, the cost of labor in the proposed plant is a small item. Beside the nominal cost for labor, the proposed plant has all the low operating expense features typical of hydroelectric stations combined with the accessibility of steam stations.

There are certain types of systems to which the proposed type of plant is especially applicable. In cases of navigable streams and those employed for irrigation purposes, the allowable interference with normal flow may be very limited so that recourse must be had to steam plants unless suitable means of storage can be developed independent of the main power site. Also in metropolitan aqueduct systems, like the Owens River development for Los Angeles and the Hetch Hetchy project of San Francisco, the flow of water must be practically uniform although it is planned to develop hydroelectric power as a by-product. In such cases, the proposed type plant offers features of more complete conservation and economy which should not be underestimated. And in any case of hydroelectric development, it seems as though storage at the load end of the line should receive careful consideration as a means of overcoming the deficiencies arising from low load factor.

SUGGESTIONS FOR CONSERVATION OF PAPER

In response to the request of the War Industries Board, the N. E. L. A. has gotten out the following suggestions for the conservation of paper:

1. Study forms used and wherever possible eliminate duplications, and by rearrangement make one form do where more than one is now used.
2. Carefully consider advertising, circulars or slips, possibly of doubtful value. See if all copies made are now necessary and used.
4. Centralize all reporting data so that it will be available upon request by inter-departments and thus avoid necessity of making duplicate records.
5. All letters should be written so clearly that it is not necessary to write again for further information.
6. Find out what paper stock the government needs most and wherever possible avoid using this class of paper.
7. Do not type copies of reports already handwritten where original will do.
8. Discontinue sending, as far as possible, so-called courtesy letters.
9. Watch purchase of supplies closely and do not order in excess of actual requirements. Most companies now have supplies on hand which will never be used.
10. Reduce space devoted to titles on letter heads to give more space for writing; also use, wherever adaptable, one-half or three-quarter size sheets instead of a full sheet.
11. Eliminate confirmation of telegrams except on most important business.
12. Avoid wastage of envelopes in sending data to the various departments.
13. Discontinue use of bond paper for inter-department correspondence.
14. Don't use valuable printed forms for scratch pad purposes.
15. Keep your supplies in good order and protected from dirt and dust. The aggregate loss through improper use of stationery is tremendous and a good percentage of all stationery purchased is unusuable due to carelessness in handling same.
16. Wherever possible, use both sides of letter heads.
17. Study conditions carefully before installing new forms and throwing out old forms, where the benefits to be derived are not absolutely apparent; in any event, use up old forms before installing new system unless by so changing, a greater saving of labor or other things can be made.
18. Discontinue if possible mailing receipts, thus saving envelopes.
19. Deliver bills where possible instead of mailing, thus saving envelopes.
20. Eliminate inter-department's correspondence where telephone or personal conversation will answer the same purpose.
21. Single space all letters and use small type in your typewriters.
22. Eliminate duplicate files of meter cards, transformer and other records wherever possible.
23. Discontinue wherever possible the practice of department heads or others having personal files. Have one general file for all correspondence.
24. Avoid making more than one carbon copy of any letter unless absolutely necessary.
25. If circular letters are to be sent, order only the required number and do not attempt to carry a stock of letters for future needs.
26. Do not print a large number of collection letters in advance. Most of these are never used.
27. If proper care is exercised in receiving mail, envelopes can be used for scratch purposes by opening both ends. Aggregate amount of paper saved for normal scratch pad purposes will be large by so doing; these can be cut and padded if deemed advisable.
28. Go over old records that are now in files of previous years and which will not be referred to, such as old lamp records, work reports, etc. Have these padded, using blank side for memo or other purposes.
29. Do not permit purchase of stationery without first considering the absolute need of same, quality and quantity necessary.
30. Analyze reporting needs and issue instructions that only specified number of copies of each report shall be made.
31. Do not use bond paper for forms which are of temporary nature, such as time cards or work orders which are not a matter of permanent record.
32. A number of companies may have obsolete forms discarded and never used, only printed on one side. It is possible this paper could be made available by using the reverse side for current needs.
33. Instruct stenographers not to destroy letters on which error has been made but to use reverse side for carbon or other purposes.
34. Before ordering additional forms, consult with local printer and find out whether such forms create wastage in cutting and printing due to size . Rearrange forms to meet the most economical use of all paper.

A PLAN FOR POWER DEVELOPMENT

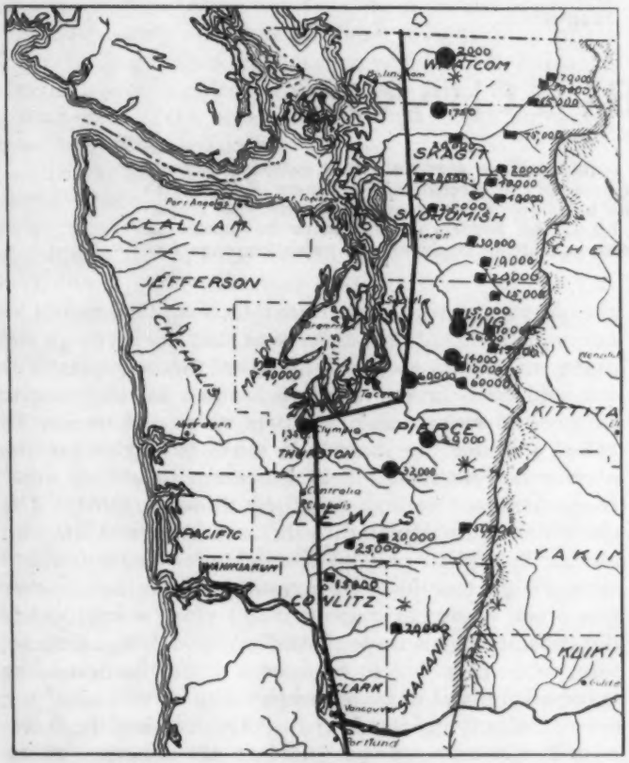
BY C. EDWARD MAGNUSSON

(A basic plan for natural water power development which applies the principle of the Reclamation Service to the electrical field. A really new idea which permits of government aid without doing away with private enterprise. The author is professor of electrical engineering and director of the engineering experiment station at the University of Washington.—The Editor.)

A Plan for National Development

To develop hydro-electric systems on a large, comprehensive plan is not only commercially possible, but economically desirable. Fortunately this does not necessarily call for a large expenditure of funds at the beginning, but merely requires a central, unifying authority which, as the systems would be of interstate scope, naturally should be the United States Government, represented by a Board of Commission.

For legislation on national water power resources the proposed industrial development should be considered on the basis of natural geographical



The proposed plan as applied to Western Washington. The sites indicated here show only the power that could be developed at a cost no higher than that of those already in operation. In consequence, although the total is over a million h.p.—the total for the state should be reckoned as much higher, in the neighborhood of from 6 to 13 million.

divisions, which must be taken as the industrial units in place of individual power projects or the needs of each separate municipality. To make this clear a typical region may be selected to which applications may be made in specific terms, although the same principles apply to all parts of the country. Thus legislation for the development of the water powers of western Washington should fundamentally deal with all the power resources of the whole Puget Sound basin and in addition be susceptible of expansion into Oregon, western Washington and Canada.

Specifically Applied

The key or controlling link in a large hydro-electric power system is the High Tension Trunk Transmission Line. Using the Puget Sound region as a typical example, and referring to the accompanying map, the application of the fundamental principles may be made more specific. The heavy line on the map represents the location of the proposed Trunk Transmission Line for this region. The small circles indicate the location of power plants already constructed, with figures giving the installed generator capacity, in each case stated in h.p. The rectangles indicate the location of power sites with the figures giving the available h.p. that can be developed at a cost no greater than the average of the plants already in operation. The estimates as shown are very conservative, and yet the capacity of the power sites specially indicated on this map totals over a million h.p. These figures could be greatly increased by storage, and by including a large number of smaller sites which under the proposed central trunk line system would be made available, and which, in many cases, could be developed at a very low cost per h.p.

With Governmental Control

All the power plants in the region would deliver power to the Trunk Transmission Line, and likewise all consumers of power would obtain electric power from the Trunk Line. It is apparent that by owning and operating the Trunk Transmission Line, the United States Government would unify the entire system and thus could provide regulations that would insure a rational development of all the power resources. This would include power that could advantageously be obtained from otherwise inaccessible coal fields or from low grade coal beds. Steam power plants located at the coal mines would, in many cases, make a most desirable combination with the hydro-electric units by providing the necessary reserve power during the annual low-water period.

The Factors Involved

The main features of the plan as applied specifically to the Puget Sound region, but which expressed in general terms would apply to all parts of the country, may be summarized as follows:—

1. The United States Government should construct and operate a High Tension Transmission Trunk Line, extending from the Canadian border, in the vicinity of Sumas in a southerly direction across the State to the Columbia river, a distance of approximately two hundred and sixty miles (see the accompanying map). Branches or Laterals (not shown on the map) of the Trunk Line System should be constructed up river valleys having several power sites, on a somewhat similar basis as the laterals to the main ditches in government irrigation systems.
2. The operation of the line to be in charge of a Federal Board or Commission.

3. The Federal Board would purchase electric power from privately owned (individuals, corporations, or municipalities) and operated power plants. Each power plant to connect to the Trunk Line system at the nearest accessible point. Power to be contracted for on definite schedules and at published rates.
4. The Federal Board would also contract to sell power on a wholesale basis to distributing agencies as, municipal light and power departments, public utility corporations, railroads, manufacturers and individuals, on definite schedules and at published rates.
5. The difference in the selling and purchase price should be made sufficient to cover operating expenses, interest on the investment, maintenance and depreciation of the Trunk Line system.
6. The Federal Board would authorize the development of new power projects so as to have an adequate supply of electric power available to meet the demands of the whole region.
7. To insure continuity of operation two complete three-phase transmission lines must be installed, in parallel, along the route indicated on the map. The approximate cost of such a duplex Trunk Transmission Line (assuming the cost of labor and material to be 50% higher than before the war) would be $14,000 per mile.

No Monopoly

The plan eliminates the monopoly feature which otherwise becomes a dominating factor in hydro-electric developments; it makes it economically possible to develop the small as well as the better known large water power projects, and also otherwise inaccessible coal beds; it opens the hydro-electric development field to men having comparatively small capital; it enables each municipality to operate and control its own distribution system and to obtain an adequate supply of electric power at reasonable rates under the direct control of the United States Government; it gives assurance to the manufacturer that electric power at low rates will be available in abundance wherever it is found desirable to locate an industry; it outlines a comprehensive scheme by which all the power resources of any region may be developed in the most economical way and by which electric power can be made available for industrial purposes wherever needed.

Fundamentally, it is proposed to apply the principle of Government owned and operated main ditches in national irrigation systems to the utilization and unification of the national hydroelectric resources.

READY TO SERVE CHARGES

BY C. E. GRUNSKY

(There is perhaps a greater peak in the service required of an electric power company than in that of any other type of public utility and the necessity of meeting the expenses of this extra installation is reflected in the rates allowed. The basis for ready-to-serve charges and a suggestion that in the case of water companies, at least, the burden might better be passed to the entire community. The author is a well known consulting engineer and valuation expert of San Francisco.—The Editor.)

Rates for Electric Energy

More attention has probably been given to an adjustment of the rate schedule to the cost of the service in the case of supplying electric energy than in the case of rendering any other public service. There is good reason for this, because the demand of individual consumers has an exceptionally wide range and the consumers are often isolated and scattered throughout a large territory. The preparation to serve must be adjusted to the demand of each large consumer and to the group and frequently individual demands of the smaller consumers. In the transmission of energy by electricity perhaps more than in rendering any other public service the broad principle can be applied as indicated by the Wisconsin Railroad ommission that the rates for electric current should be based on the cost of the service. The electric power concern adjusts its installation as stated to a close conformity with the requirements of individual consumers. This is not nearly so essential in the case of a water works which makes its installation to meet the possible future demand throughout the length of a street or throughout an urban section generally at a capacity far in excess of the immediate demand, and which commands with each size of service connection a wide range of demand. In the one case ready-to-serve means more to the individual consumer than in the other.

The electric power concern must make its plant and transmission lines and the installation to serve the individual consumer, adequate to meet the collective and individual requirements. Where the maximum demand may at some time reach 500 horsepower the preparation to serve must be for the amount of energy. It makes no difference that the average demand may be for only one-fourth of this amount. The line and transformer installation must be adequate to supply the maximum amount of energy that may be called for and the main line must be such that the service can be rendered at the same time that other consumers are calling for their allowed limit. The charge must be adjusted to this condition and the unit charge if applied only to the delivered energy would appear higher under such a condition than for another consumer whose average demand closely approaches the capacity of his motor installation. There is, therefore, when rates are to be fixed a determination to be made of the cost of being prepared to serve and of the cost of supplying the energy. The costs thus determined will then be the guide to the charges which should be made to make the business profitable. In line with this reasoning the operating expenses, with inclusion of interest on the investment, naturally fall into two classes of which the one class will include only such expenses as are independent of the energy output and the other will include those which vary with the output of energy. The basis of the charge to the consumer will then be the sum of these distributed costs with profit added. Consideration of the stable or demand cost items, in distinction from the variable or energy cost items, naturally leads to the fixing of a minimum charge which ordinarily will also cover the cost of meter reading, billing and collecting.

Gas and Water Rates

The consumer is generally required to pay for the service connection with gas and water mains. Gas

and water meters are furnished to him without charge. So long as gas and water are not turned off from any premises the meters are read, bills are made out and charges are collected. There is here, therefore, a service rendered independent of the amount of gas and water consumed for which some charge is legitimate. When, however, premises are vacated and the gas and water are turned off the premises are restored almost to the condition of the unimproved lot. The only difference is the presence of a service connection and a gas and possibly a water meter which are subject to a charge for future replacement (depreciation) and to an interest charge on the capital invested by the utility, if there be any, in the connection and the meter. These elements of cost are often too small to deserve serious consideration as the sole basis for a rate, particularly when such a rate is to be assessed against vacant premises and would therefore fall into a time when the owner's income is less than ordinary and he is least able to pay. Ordinarily there will be so little difference between the lot with a vacant house and an unimproved lot that if there is to be a ready-to-serve charge in the one case the question may well be asked—why not in the other? If anything apart from raising rates is necessary to swell earnings should it not, as already suggested, take the form of a waiver of taxes or an increased payment for water used for public purposes?

In the distribution of the aggregate amount to be earned there will always be some comprehensive or class treatment necessary which can not be made absolutely fair to each individual rate payer and property owner. He who lives on the hill top may not at all times get his water under as great a pressure as his neighbor at the foot of the hill. Or, again, no difference will be found in the rates applied to property owners in some district which is at so high an elevation that water must be pumped, and the rates applied to those whose needs can be met by gravity flow. In such circumstances the ordinary practice is to treat the entire municipality as a unit and to regard the service rendered as no more valuable to the hill top resident than to the one who lives at a lower elevation. This is a wise rule; though there are cases in which it has not been followed, in which there is an additional local charge based on pumpage or other similar expenses.

That the unit cost of any commodity or of service obtained from a public utility should be greater to the small consumer than to the large consumer will ordinarily be accepted as reasonable. But an accentuation of this disparity by easing up on the large consumer as his consumption increases, is often unwarranted.

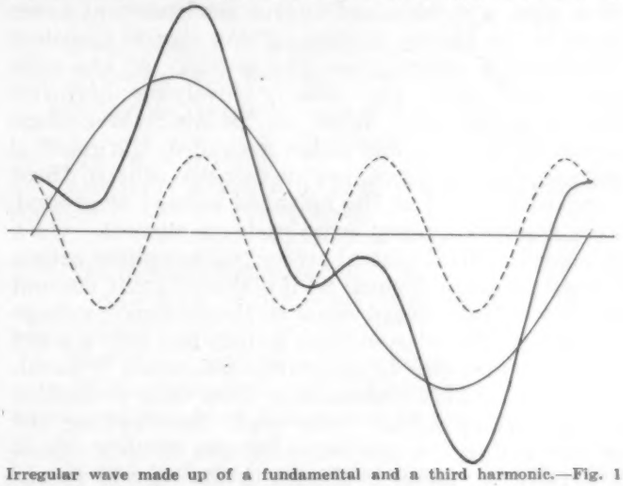
By reference to almost any schedule of water rates it will be found that the charge for furnishing the water decreases as the amount increases. This arrangement of the schedule except as necessary to cover the expenses of meter reading, billing and collecting and the like is not always as unfair to the small consumer as a mere comparison of the unit rates may indicate. If the large consumer is conducting an enterprise which is worthy and needs help from the community, it may well be claimed that aid should be extended in some way that will insure a contribution from all property owners and not under cover of an inequitable water or gas rate. After provision is made to obtain from each consumer the special charge against his individual service, why should not, in other words, the unit rate for gas and water be uniform to large and small consumers alike? The answer is that it should be, whenever the demand for the service or output of the utility is at the limit of or exceeds the plant capacity; but that when this is not the case it may be to the advantage of the small as well as the large consumer to encourage large scale consumption even though at less than average rates because revenue is thereby increased without materially affecting the aggregate cost of operation. It will not do, therefore, to condemn offhand a rate schedule because it seems to favor the large consumer. All the circumstances of the case must be considered before a satisfactory conclusion can be reached.

PRIMER OF INDUCTIVE INTERFERENCE

BY D. I. CONE

(Inductive interference as it affects telephone and telegraph systems under normal conditions—and in the case of accidents to the parallel high tension transmission line. The author of this series of articles on the elements of inductive interference was prominent in the recent California investigation of this complicated subject.—The Editor.)

Most alternating-current power systems use a frequency of 60 cycles per second. To a lesser degree 50, 25 and various other frequencies are used. High-speed telegraphy employs currents whose pulsations may be represented by waves of fundamental frequency of 30 or 40 cycles per second or even more, and it may be seriously interfered with in practice by currents of frequencies up to 200 cycles or more.



Irregular wave made up of a fundamental and a third harmonic.—Fig. 1

Thus the fundamental frequencies now in common use in power systems are in the range of greatest detrimental effect to telegraph operation. On the other hand telephone systems under normal conditions experience little or no appreciable interference from the fundamental frequencies of the power systems, as the range of frequencies to which the ear and the telephone apparatus are sensitive are higher, say from 100 to 2000 or more cycles. That is, it is the so-called higher harmonics, the irregularities in the voltage and current waves of the power circuit, that interfere with telephony, by causing humming and buzzing noises.

The basic idea of the word harmonic is that of a sine wave. It is permissible to speak of an irregular voltage or current wave as containing higher harmonics because of the law, due to Fourier, that any such irregular wave can be analyzed into a series of sine waves of various sizes and phases, of 1, 2, 3, 4, 5, etc. times the fundamental frequency. Only the odd multiples (1, 3, 5, etc.) are ordinarily present in alternating current and voltage waves, owing to the fact that successive half-waves are alike but reversed in sign. Fig. 1 shows a simple case of an irregular wave together with the fundamental and third harmonic waves composing it.

Causes of higher harmonics are (1) irregularities in the flux distribution in alternators, governed by the shape of the pole pieces, location of field winding-slots; and (2) presence of pulsating resistance or reactance, as in the case of arcs on the variable permeability of the iron cores of transformers.

The higher harmonic currents and voltages represent small amounts of energy compared to that being transferred along the power circuit by the fundamental voltages and currents; also the induction into a parallel communication circuit of any frequency is a very small fraction of the energy flow along the power circuit. However, the energy required to operate the delicate mechanisms of communication apparatus is so minute that the energy received by induction in communication circuits easily attains a magnitude comparable to the operating waves.

The discussion so far has been concerned with induction under normal conditions. When an accident occurs to a power circuit, such as the falling of a wire, a sudden and violent readjustment takes place in the energy storage, giving rise to transient residuals, of many times the severity of the ordinary conditions, and usually involving high-frequency oscillation. When an isolated three-phase power system has one phase grounded, the residual voltage changes from, say, a few per cent to three hundred per cent of the balanced voltage to ground, with a corresponding large residual current. On a grounded-neutral system grounding one phase causes a residual current equal to the short-circuit current and a residual voltage equal to the balanced voltage to ground. These conditions usually last only a short time, but give rise to dangerous potentials in parallel communication circuits, operating their protective devices or damaging apparatus, interrupting the service and in the case of telephone circuits, sometimes causing acoustic shocks to the ears of operators or patrons. Transpositions of either power or telephone circuits are of no avail in these circumstances, the only remedies, other than increased separation of the two classes of circuits, being to minimize the number and severity of the disturbances to the power system.

LONG SPANS IN NORWAY

The power-transmission line from Florli to Stavanger was recently completed and is ready for service, awaiting only the completion of the power plant at Florli. The line is built with copper cable stretched on wooden trestles with spans of 250 meters (273.4 yards), and has a capacity of 50,000 volts. Hogsfjord is crossed by a single span with a length of 1,384.2 meters (1,513.76 yards), one of the longest in the world. The span is composed of three cables of crucible steel, since copper or aluminum would not be able to stand the strain. Copper-sheathed cable would have been preferable to prevent loss of voltage, but under present conditions it could not be obtained. Each cable has a diameter of 16 millimeters (0.63 inch), is composed of 19 strands, and has a tensile strength of 150 kilos per square millimeter (330 pounds per 0.00155 square inch), and a total of about 22 metric tons for the whole cable. A sufficient margin of safety is thereby secured, as in calm weather a strain of 4 tons is exerted on the cable between the two terminals, which increases to 7 tons in a high wind.

A SURVEY OF CANADIAN WATER POWER

During recent years, the Canadian Government, through the Dominion Water-Power Branch of the Department of the Interior, has devoted much attention to the systematic examination and development of the hydraulic resources of the Dominion, according to the Electrical Review of London, and the data, as regards the largest, most readily available and most promising water-powers are sufficiently complete to permit a reasonably close idea of their possibilities to be obtained.

The Canadian Conservation Committee estimates that of the 3,730,000 square miles of the Dominion, 2,000,000 miles may be expected to be fairly thickly settled within the next few decades. The remaining area is known to have thousands of water-powers, but the capacities of these are imperfectly known and they are remote from any present market. Excluding these districts, it is estimated that 18,800,000 h.p. is available. This amount does not take into account the possibilities of storage for the improvement of present capacities. The power actually developed up to 1918 amounted to approximately 1,736,000 h.p. About 78 per cent of this is used for electric light and electric railway and motive-power work, but some 250,000 h.p. is utilized in the manufacture of paper from wood pulp, and about 150,000 h.p. in electro-chemical and similar processes.

Powers as yet undeveloped, but which are capable of rapid and easy development, aggregate 5,400,000 h.p. In addition to these, existing plants could be extended so as to develop an additional 280,000 h.p. so that an aggregate of 7,500,000 h.p. is readily available within range of present markets. At the present accelerated rate of development it appears more than probable that the whole of this energy will be utilized within the next 20 years or so.

The policy of the Government in respect to the control and administration of water-powers is that the title should be retained by the Crown, that the public should be protected by securing the maximum advantageous development of each river, by control of the rates, by reasonable rentals, etc., and that at the same time the inducements should be such as to encourage legitimate enterprise for the development of power resources.

SAVING THE WASTE IN THE CHIMNEY---I.

BY ROBERT SIBLEY AND CHAS H. DELANY

(To properly understand how to save the waste occasioned by the chimney and its accessories in the modern power plant—oil fired—a knowledge of the fundamental laws of chimney design is necessary. Here is the beginning of a number of articles on this important subject by the authors of the well known book on "Fuel Oil and Steam Engineering." These articles should prove helpful and timely in the present campaign for increasing power plant fuel economy.—The Editor.)

It is a well known fact that transference of heat by convection currents accomplishes the freezing of lakes in the mountains and the boiling of the tea-kettle in the kitchen. In the latter instance it will be recalled that the layer of water along the portion of the tea-kettle exposed to the heat application becomes heated and expands, thus making its density less than the density of the water in the layer above; consequently this lower water immediately travels to the water surface to make way for the cooler, heavier water above. In the succeeding course of events this water too becomes heated, expands and travels upward to make way for other cooler water which in turn is heated and forced to the surface. This circulation or transference of heat eventually raises the temperature of the water to such heights that steam generation occurs.

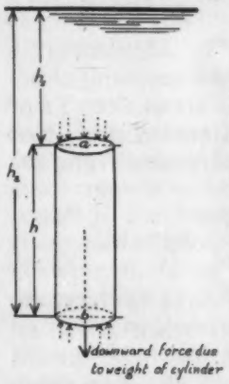


Fig. 1—An analogy in which the chimney is considered as a vertical cylinder immersed in water. The forces that act under such conditions are quite comparable to the forces acting upon a cylindrically shaped chimney. The downward pressure of the air upon the chimney from above plus the weight of the cylindrical column of heated gases within the stack are not equal to the pressure of the heavy dense air entering the boiler furnace, so the entire cylindrically shaped column of heated gases is forced upward and we have chimney draft.

In looking into the elementary theory of chimney draft it is found that exactly similar convection currents take place. The air or gas in the chimney is raised to a high temperature by the absorption of enormous quantities of heat given out by the fuel in combustion and consequently this air expands and becomes lighter in density than the air in the atmosphere without. Hence this heavier air pushes up through the grate or furnace entrance and expels the heated air within only to find itself a few moments later also forced up through the chimney by still other heavier without. And so the process continues.

An Hydraulic Analogy.—It will be recalled that at the time of the sinking of the Titanic the popular idea was that in a deep sea some questioned whether this ship ever actually reached the bottom. Indeed, in the celebrated writings of Jules Verne entitled "Twenty Thousand Leagues Under the Sea" it is stated that the famous Captain Nemo observed in the Red Sea the chariots the Egyptians used in following the Children of Israel, suspended in mid-sea, never having sunk to the bottom.

The action of chimney draft is best illustrated by taking an hydraulic analogy and in this analogy it is easily proven that the Titanic must have sunk to the bottom as must also the chariots of the Egyptians.

Suppose a cylinder is immersed in water as shown. The forces or pressures acting upon the cylinder are, from elementary considerations of hydraulic pressures —

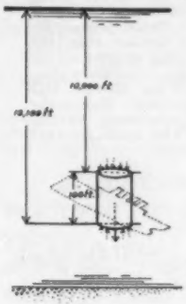


Fig. 2.—An illustration showing why heavy bodies—such as the steamship Titanic—must sink clear to the bottom of the ocean. The density of water increases very slightly with depth, hence five or six miles below the surface—such depth representing the deepest areas of the ocean—the unbalanced density of a heavy body of iron would still vastly exceed the displaced water and the body would continue to sink.

Downward pressure of water $= h_1 w A$
Downward weight of cylinder $= h w_1 A$
Upward pressure of water $= h_2 w A$

In which, h_1, h_2 and h are shown in Fig. 1, and

A = area of cylinder
w = wt. of cubic ft. of water
w_1 = wt. of cubic ft. of cylinder

If the density of material in the cylinder is less than the density of outside water, we have

$$\text{Net upward pressure} = h_2 w A - h_1 w A - h w_1 A$$
$$= wA(h_2 - h_1) - h w_1 A$$

But $(h_2 - h_1) = h$
Also let $w A h = W$ or total weight of water displaced,
$w_1 A h = W_1$ or total weight of cylinder.

$$\text{Net upward pressure} = wA(h_2 - h_1) - h w_1 A = wA h - w_1 hA$$
$$= W - W_1 \quad \text{(1)}$$

Hence it is seen that the total net upward pressure on this cylinder is the difference in weight of a column of water of dimensions of the cylinder and of the cylinder weight itself.

If this cylinder is heavier than the water displaced, such as the steel or material of a ship, it will continue to pass downward until solid bottom is reached, since the density of water increases in extremely small degree as great depths are encountered.

In case of a cylinder lighter than the water displaced, the reverse takes place. And this brings us to a consideration of the laws of pressure in chimney draft.

Thus, let us suppose that the Titanic was of cylindrical shape for easy computation and that it was at a depth of 10,000 ft. below the surface of the sea. Let us assume the cylindrical depth of the Titanic

to be 100 ft. and that the area of each end is A sq. ft. A cubic foot of sea water weighs 64 lbs. at atmospheric pressure, and approximately 65 lbs. at the great pressure attained 10,000 ft. below the surface.

Therefore we have

Upward pressure $= 10100 \times 65 \times A$
Downward pressure $= 10000 \times 65 \times A$
Downward wt. of cylinder $= 100 \times A\, w_1$

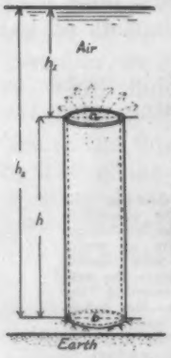


Fig. 3.—A section of a chimney—cylindrical in form—shown immersed in a sea of air, which approaches the actual chimney draft theory met with in practice. The air may be thought of as a vast ocean in which the ordinary chimney is located at the bottom. A cylinder of heated air gas within the chimney, being lighter than the colder, heavier air without, is thus started on its upward journey. This sea of air is unlike water, however, in that the strata of air become less dense as we leave the earth's surface. Hence the cylinder of air will not rise completely to the surface of the air sea but will rise until its particular strata density is reached.

Hence net downward pressure at 10000 ft. or approximately 2 miles below the surface is

$$10000 \times 65\, A + 100\, A\, w_1 - 10100 \times 65\, A$$
$$= 100\, A\, w_1 - 100 \times 65\, A$$
$$= 100\, A\, (w_1 - 65)$$

Hence as long as w_1 is greater than 65, the weight of a cu. ft. of water at the depth of the ocean the ship will continue to sink. The weight of a cubic foot of water increases less than one-half pound for each mile of depth, so it is obvious its weight can never equal that of a cubic ft. of steel.

The Law of Pressures in Chimney Draft.—Let us consider a volume of gas or air housed up in a chimney of area A and height h. We may consider this cylinder of air as immersed in a sea of air with its faces respectively h_1 and h_2 ft. below the surface. This is quite approximately the actual conditions in the air surrounding the modern power plant.

Let w = wt. of a cubic foot of air without,
w_1 = wt. of a cubic foot of heated air within.

Let p_1 = the unit pressure of atmosphere at a
Then evidently $p_1 = w\, h_1$
Also p_2 = the unit pressure of atmosphere at b
Then $p_2 = w\, h_2$

Hence
Total downward pressure at a $= p_1\, A = w\, h_1\, A$
Total upward pressure at b $= p_2\, A = w\, h_2\, A$
Total down pressure due to weight of air in chimney $= w_1\, A\, h$

Total
Net upward press. $= w\, h_2\, A - w\, h_1\, A - w_1\, h\, A$
$= w\, A\, (h_2 - h_1) - w_1\, A\, h$
But $h_2 - h_1 = h$
$\therefore$ Total net upward press. $= w\, A\, h - w_1\, A\, h$

Let W = weight of a cylinder of outside air of dimensions of chimney $= w\, A\, h$
W_1 = weight of a cylinder of inside air of dimensions of chimney $= w_1\, A\, h$

$\therefore$ Total net upward pressure $= W - W_1$ ..... (2)

Hence the total pressure that tends to force the heated gases out of a chimney is computed by subtracting the weight of the chimney gases in the chimney from the weight of an outside volume of air equal to the volume of the chimney.

The Theoretical Draft.—In thermodynamics, we find that the weight of a so-called perfect gas, in which classification chimney gases are placed, may be computed from the formula

$$pV = WRT \quad \text{..... (3)}$$

in which p is the pressure in pounds per sq. ft., V the volume considered in cubic feet, W the weight in pounds, R a constant (which for air is 53.3) and T the absolute temperature of the gas in degrees Fahrenheit.

Let us assume that the pressure of the atmosphere is 14.7 lb. per sq. in. or 14.7×144 lb. per sq. ft., that V is unity or in other words one cubic foot, and that the temperature of the entering air is 62°F. or on the absolute scale is $(459.6 + 62)$ F. We now have that one cubic foot of entering air weighs

$$W = \frac{pV}{RT} = \frac{14.7 \times 144 \times 1}{53.3 \times 521.6} = .0761 \text{ lb.}$$

The average temperature of the outgoing chimney gases is in economic practice about 500° F. or 959.6° F. on the absolute scale. Hence a cubic foot of this air will weigh on its emergence from the stack

$$W = \frac{pV}{RT} = \frac{14.7 \times 144 \times 1}{53.3 \times 959.6} = .0414 \text{ lb.}$$

The difference of .0761 and .0414 is .0347 lb. If now we assure that the chimney stack is 100 ft. high we find that the entering air forces itself inward with an unbalanced force of 3.47 lb. over every square foot of cross-sectional area in the chimney.

In engineering practice this draft pressure is not usually recorded in pounds pressure per sq. ft. of chimney area. Instead of this unit, the engineer measures the height to which a column of water would be forced under this pressure. In other words, since water, one square foot in cross-sectional area, at the temperature of the boiler room usually weighs 62.0 lb. for every foot in height, to bring about a pressure of 3.47 lbs. per sq. ft., the water would have to rise to a height of

$$\frac{3.47}{62.0} \text{ ft., or } \frac{3.47}{62.0} \times 12 \text{ in.} = 0.67 \text{ inches of water}$$

Hence it is seen that under normal conditions of operation in the modern chimney, the theoretical draft should read 0.67 inches of water, when the stack is 100 ft. high.

This theoretical intensity of draft can never be actually observed with a draft gage or any recording device. If, however, the ash pit doors of the boiler are closed and there is no perceptible leakage of air through the boiler setting or flue, with a stack 100 ft. high filled with gases at 500° F., and with external air at 62° F., a draft gage connected to the base of the stack will read approximately 0.67 inches.

RAILWAY ELECTRIFICATION RECOMMENDED

(Electrification of the mountain divisions of the California railroads has been recommended to Director-General of Railways McAdoo by D. M. Folsom, director of the Pacific Coast section of the Oil Division of the Fuel Administration, as a means of conserving the use of fuel oil and reducing the total operating expenses of sections of the railroads involved by $4,923,300 a year. The investigations on which the report was based were made by W. F. Dietrich, engineer for the Pacific Coast section of the Oil Division of the Fuel Administration, working under the direction of Folsom.—The Editor.)

The subject of the electrification of the Western Railroads has come up for discussion before the various technical societies during the past five years, but thus far the engineers of the railroad companies involved have been unable to show a balance in favor of electrification. The electrification of the Tehachapi Pass, from Bakersfield to Mojave, was discussed by A. H. Babcock, electrical engineer of the Southern Pacific Company, in the Proceedings of the American Electrical Engineers, September, 1913, wherein it is shown that under the conditions at that time the electrification of that district would not have been justified from a financial standpoint. Whether or not the conclusions reached at that time were correct, there have since been numerous changes in conditions that place the subject in a different light. The cost of fuel oil, upon which Mr. Babcock's report was based, was 40 cents per barrel. The cost is now $1.60 per barrel of 42 gallons, at the fields or pipe-line terminals, to which must be added freight charges to the point of use, and there is every reason to believe that this price will never be reduced. Mr. Babcock's report was made over a relatively short piece of road—68 miles, so that the showing in favor of electrification was necessarily poorer than it would have been if a longer district had been considered. The engineering details in Mr. Babcock's report are for the most part above criticism, although there is a strong tendency to adopt abnormally high unit costs in some cases, and there is room for a wide difference of opinion in regard to the sub-station layout, and the number of locomotives chosen for the work.

Districts Considered for Electrification

The districts considered for electrification in this report are (1) Part of the Sacramento Division of the Southern Pacific Company, from Roseville, California, to Sparks, Nevada, (2) Main line of the Shasta Division of the Southern Pacific Company, from Gerber, California, to Ashland, Oregon, and (3) Part of the San Joaquin Division of the Southern Pacific Company, from Bakersfield to Saugus, California. The Atchison, Topeka and Santa Fe Railway uses the Southern Pacific Company tracks from Bakersfield to Mojave.

These districts are selected because as traffic increases on a given railroad it is in the mountain districts that electric operation first becomes more advantageous than steam operation, and the districts chosen are the only mountain districts in California where traffic is sufficient to warrant the conversion from steam to electricity. It is quite likely that by the time these districts are electrified it will be found advisable to extend the electrification to other parts of the main trunk lines in California, and to the suburban lines in other parts of the state.

First Costs and Annual Operating Expenses

The first costs and annual operating costs, as determined subsequently in this report, are summarized below:

FIRST COSTS AND ANNUAL OPERATING COSTS

Division	Net First Cost.	Annual Saving in Operating Cost.	Percentage Net Profit on Invest.
Sacramento	$8,100,000	$1,592,600	7.6
Shasta	8,038,000	1,903,300	11.7
San Joaquin	6,874,000	1,426,900	8.7

In calculating the profit on the investment, 12% is allowed for depreciation, amortization, taxes and interest. Even with electricity at $1.00 per kw-hr. and a net investment of $30,000,000, a 2% net profit could be made with oil at the present price of $1.60 per barrel, assuming that the saving in oil, the power requirements, and the annual operating savings calculated in this report are reasonably accurate. No showing can be made for electrification with oil at less than 90 cents per barrel. Any rise in the price of oil above that figure would be justification enough for a reconsideration of the feasibility of electrification by the engineers of the railroad companies.

Summary of Power Requirements

The following table gives a summary of the power required and the fuel oil saved by the electrification of the Mountain Districts considered in this report:

POWER REQUIREMENTS FOR PROPOSED ELECTRIFICATION

Division	Kw-hr. per Day.	Kw-hr. per Year.	Kw. Av. Dem.	Kw. Max. Dem.	Saving in Fuel Oil, Bbls.	Saving in Fuel Oil, Value.
Sacramento	285,500	104,200,000	11,900	47,600	978,000	$2,200,000
Shasta	200,500	73,200,000	8,350	33,400	907,300	2,055,000
San Joaquin	244,000	89,000,000	10,150	40,600	1,177,000	1,882,000
	730,000	267,400,000	30,400	121,600	3,062,300	$6,147,000
Value of fuel oil saved at $2.02 per barrel (average)						$6,147,000
Cost of electricity at $0.75 per kw-hr.						2,000,000
Annual saving in cost of power						$4,147,000

For the purpose of comparison, the following figures of fuel oil consumption by the western railroads during 1917 are given:

	Consump. Fuel Oil, Barrels.	Per cent saved by Proposed Electrification
Southern Pacific Co.	15,686,354 / 5,856,901	14.22
All Western Railroads	24,349,247	12.6
Total for California	10,450,000	29.3
Total California Fuel Oil Production	78,000,000	3.93

While throughout the report the purchase of hydroelectric power is considered, it should be pointed out that even if the power were generated by oil, there would be a saving of about half the present consumption of locomotive fuel. Thus 267,400,000 kw-hr. would require, at 200 kw-hr. per barrel, 1,337,000 barrels of oil, or 43.6% of the present

consumption of locomotive fuel oil for the three districts. The cost of this oil alone would be $700.000 per year more than the cost of hydroelectric power at $0.75 per kw-hr.

An annual load factor of at least 40% would be possible, provided that the three districts were all connected to a common power system. Even this figure is capable of improvement with proper attention to train dispatching.

The question of whether an electric railroad should purchase its power or generate its own power is one that can be disposed of in a few words. The monthly load factor for industrial uses average 52% in California. The load factor for an electric railway will seldom exceed 40%. Hence the railroad is much more easily absorbed by a larger system, serving diversified industries, than by a system supplying the railway alone. The larger the power company, the less will the total load factor be decreased by the addition of the railroad load.

Unit Costs

As the factors affecting construction and operation of electrical equipment are essentially the same in all three of the districts considered, it is possible to use the same estimates of unit costs of construction and maintenance in each case. The unit costs adopted for this report are given in the following tabulation:

FIRST UNIT COSTS AND OPERATING COSTS

First Cost.	Unit-Cost.
Substations, per kw.	$ 45.00
Track bonding, main line, per mile	1000.00
Sidings, etc., per mile	800.00
Transmission line, per mile, steel pole	8000.00
Contact system, overhead, main line, per mile	8000.00
Third rail, main line	8000.00
Sidings, etc.	6000.00
Block signal changes per mile of main line	2000.00
Electric locomotives, per ton on drivers	600.00
Shops and inspection sheds, per division	15,000.00
Locomotive credits, per locomotive	31,000.00

Maintenance.	Annual Charges.
Substations, per kw-hr. input	$ .001
Contact system, per mile	150.00
High tension line, per mile	75.00
Track bonding, per mile	30.00
Maintenance of way and structures, per cent of steam costs	75 %
Freight locomotive enginemen, per cent steam	80 %
Locomotive repairs, electric, per locomotive mile	.06c
Per cent of steam costs	50 %
Passenger locomotive enginemen, per cent steam	60 %

A few words of explanation are in order regarding the origin of certain of these figures. Under normal conditions, by which is meant pre-war prices, the unit cost for substations of the type required is in the neighborhood of $30 per kilowatt, as for example, the Chicago, Milwaukee & St. Paul electrification in 1915. At the present time, September, 1918, the cost of similar equipment is about $50 per kilowatt, which must be regarded as somewhat inflated. Hence it is considered that the price of $45 per kilowatt is within the bounds of conservatism.

The cost of track bonding was taken from the costs of similar work in recent installations, plus 50% for increased prices. The cost of block signals changes was determined in the same manner.

The figure of $8000 per mile for steel tower transmission line allows a wide margin for increased prices. This item could well be reduced for the Shasta division where the traffic is not as heavy as on the other districts, and where wooden pole construction might prove more economical in the end than steel tower construction. The wooden pole transmission line for the Chicago, Milwaukee and St. Paul electrification cost $3000 per mile. Similar construction at the present time would cost $5000 per mile.

Regarding the contact system, at the present time third rail construction is cheaper than overhead. The wooden pole overhead contact system for the C. M. & St. P. electrification cost $5,500 per mile. At the present time this would cost $9000 per mile. The unit cost per mile for sidings, spurs and wyes, may be thought too low, but it must be remembered that much of this work on yards and sidings will be done by means of overhead suspension, spanning two or more tracks, and that the cheapest possible construction on most of the spurs and wyes.

The cost of the C. M. & St. P. electric locomotives was $535 per ton on drivers. These locomotives could be duplicated today for $715 per ton, so the figure of $600 per ton is considered reasonable for the purpose of this estimate.

The figures on maintenance costs have been compiled mainly from the published data on recent installation, making due allowance for the present high prices and after due consideration of the operating conditions on the proposed electrification.

The value of steam locomotives released for service elsewhere is based on the average valuation of the locomotives in service at the present time, after making an allowance for shopping, extras, etc.

The relative economies of electric operation over steam in such items as Maintenance of Way and Structures are taken from the result of other electrifications. About 60% or more of the total annual cost of Maintenance of Way and Structures is directly chargeable to the Maintenance of Way affected by the rolling stock, of which the larger proportion is chargeable to the locomotives. This is the largest item that is directly affected by electrification, but the elimination of fuel and water stations with their upkeep is also of importance, and that the net result of the electrification is to lower the annual charges for Maintenance of Way and Structures by 25%.

FIRST COST

	Sacramento	Shasta	San Joaquin
Substations:			
Spacing about 20 miles, 7 required, capacity:			
55,900 kw. at $45	$2,475,000		
60,000 kw. at $45		$2,700,000	
65,000 kw. at $45			$2,825,000
Track Bonding:			
255 miles main line at $1000	255,000		
143 miles sidings, etc., at $800	115,000		
215 miles at $1000		215,000	
85 miles at $800		68,000	
138 miles at $1000			138,000
75 miles at $800			60,000
Transmission line:			
145 miles at $8000	1,160,000		
200 miles at $8000		1,600,000	
125 miles at $8000			1,000,000
Contact System:			
255 miles main line at $8000	2,040,000		
143 miles sidings, etc., at $6000	860,000		
215 miles main line		1,720,000	
85 miles sidings, etc.		510,000	
138 miles main line			1,040,000
75 miles sidings, etc.			450,000
Block Signal Changes:			
255 miles main line at $1800	460,000		
215 miles main line at $2000		430,000	
138 miles main line at $2000			276,000
Shops and Inspection Sheds	15,000	15,000	15,000
Electric locomotives at $600 per ton on drivers:			
9 150-ton passenger	810,000	810,000	
28 100-ton freight	1,680,000	1,680,000	
4 100-ton switch	240,000	240,000	
11 150-ton passenger			990,000
35 100-ton freight			2,100,000
6 100-ton switch			360,000
Total	$10,110,000	$9,988,000	$9,354,000
Less Credit for steam locomotive equipment released	2,010,000	1,950,000	2,480,000
NET FIRST COST	$8,100,000	$8,038,000	$6,874,000

OPERATING COST, SACRAMENTO DIVISION

	Electric.	Steam.
Substation labor and supply	$ 104,200	
Transmission and contact system maintenance	82,700	
Maintenance of Way	490,000	$ 650,000
Locomotive repairs	250,000	390,000
Locomotive enginemen	185,500	258,000
Fuel or Electricity	783,000	2,200,000
Total	$1,905,400	$3,498,000
		1,905,400
Balance for bond interest, depreciation, taxes, profit, etc.		$1,592,600

The balance for the bond interest, etc., is 19.6% of the net investment. Allowing 12% for depreciation, amortization, interest and taxes and the net profit will be 7.6%.

OPERATING COST, SHASTA DIVISION

	Electric.	Steam.
Substation labor and supply	$ 73,200	
Transmission and contact system maintenance	70,000	
Maintenance of way and structures	510,000	$ 680,000
Locomotive repairs	230,000	461,000
Locomotive enginemen, passenger	72,000	120,000
freight	328,000	410,000
Fuel or electricity	549,000	2,065,000
Total	$1,832,200	$3,736,000
		1,832,200
Balance in favor electrification		$1,903,800

This balance is 23.7% of net first cost. 12% for taxes, etc.; net profit is 11.7%.

OPERATING COSTS, SAN JOAQUIN DIVISION

	Electric.	Steam.
Substation labor and supply	$ 89,000	
Transmission and contact system maintenance	47,000	
Maintenance of way and structures	285,000	$ 381,000
Locomotive repairs	194,000	388,000
Locomotive enginemen, passenger	39,200	65,400
freight	133,000	166,500
Fuel or electricity	668,000	1,882,000
Total	$1,456,000	$2,882,900
		1,456,000
		$1,426,900

This difference is 20.7% on the net first cost, or 8.7% net profit on investment after deducting allowance for taxes, etc.

SPARKS—Current Facts, Figures and Fancy

(The problems of reconstruction are to demand electrical enterprise as much as did those of war. The call for electrical appliances to aid cripples is among the needs of the moment. A suggestion for the application of war ideas to peaceful pursuits is further glimpsed in the use of searchlights for night time agriculture. We will yet be laying cables by submarine and transporting equipment by aeroplane.—The Editor.)

As if it were not enough to have the terrifying tanks waddling across No Man's Land with flames and smoke gushing from their sides, the western farmers have rigged up a remarkable substitute to waddle across their own farms. They are putting a powerful electric searchlight on their motor-driven plows and following the furrow across the fields at night.

* * *

Japanese patent medicines are as marvelous as are our own, to judge from the advertisement of "Vita" in the Japanese newspapers, It is "earnestly recommended" for a long list of ills ranging from "leanness of body and weakish health" to "pessimism" and "maudlin sentimentalism." And "all this is offered for the ridiculously low price of yen 1.50 per bottle."

* * *

The capture of an immense Corynolophus Rheinhardti, sometimes called the red sea devil, or illuminating fish, in California waters was reported some time ago. This fish was caught in a net one night and almost caused a riot among the crew, as they had visions of a submarine when they discovered they were hauling aboard a large fish.

* * *

The renaming of all the telephone stations along the Allied line of defense camouflages real location, should a telephone message be intercepted, but it doubtless serves another worthy cause as well. Imagine the sensation of the poor lonesome Sammy who can talk down the receiver and say: "Hello, central, give me Los Angeles," and then: "Hello, Los Angeles? This is San Francisco. I just got a message from Chicago——."

* * *

Foreign commerce will be one of the largest of the post-war interests. Philadelphia is already proposing a movement toward foreign trade education, to be fostered by the Commercial Museum. The library facilities of the museum, its resource to foreign credit information, the possibility of linking it up with the Bureau of Foreign and Domestic Commerce at Washington make it the ideal instrument for aiding the importer and the exporter.

* * *

Inventors and manufacturers of electrical appliances have an urgent task before them now in the praparation of tricycles, motor cars, and other mechanical appliances for crippled soldiers. Great Britain alone could use from 500,000 to 1,000,000 tools that would enable men with an artificial arm to carry on their previous trades. By the close of the war some efficient hill-climbing electric conveyance, priced at a reasonable figure must be ready to meet the appalling demand.

* * *

China is not backward in railroad efficiency. The carrying capacity of her freight cars is greater than our own because her cars are in motion all the time, loaded to the limit. Freight charges are on the capacity of the car, not on the weight of the load, and so the only problem is to prevent overloading. Twelve hours of daylight are allowed for unloading, with a stiff tax for overtime. Shipping in carload lots is favored and so Chinese shippers develop a great capacity for cooperation so as to get a full carload.

* * *

In 1911 there were over 26,000,000 steam engine horsepower capacity in use (including railroad locomotives) in the United States. The aggregate water horse-power developed and undeveloped has been computed as around 60,000,000. Of this latter the Secretary of Agriculture estimates 6,500,000 as developed. Making liberal allowances for correction in these several figures, it seems probable that there are in service from four to five times as many steam as water horsepower and that there are still undeveloped water horsepower equal to at least twice that of all the steam capacity in service.

* * *

Ordinary thermometers are too sluggish to follow rapid variations of temperature. It has recently been possible to construct apparatus by which variations of temperature with a frequency as great as 10 times a second may be measured. The changes of temperature in the cylinders of steam engines or explosion engines can thus be measured. The temperatures are recorded on a galvanometer connected to platinum-iridium wires of 0.02 mm. diameter consisting of 65 parts of platinum and 25 parts of iridium, the deflection depending on the resistance of the wires and, therefore, their temperature. These wires can be used up to a temperature of 1.850° C.

* * *

One phase of our war work of which we have heard very little is our exportation of silver bullion to India. India is exporting a vast amount of war material to the entente allies, but in keping with her proverbial prejudice in favor of metal money, she demands bullion in payment. The drain on the silver supply of England and France has been tremendous, and so the United States is now taking the great amount of silver bullion and silver dollars lying idle in the Treasury and is exporting it to India in payment for war supplies.

PERSONALS

James M. Barry, formerly chief of the Department of Electricity of the city of San Francisco and more recently electrical engineer for the Great Western Power Company, has left for Birmingham, Alabama, where he is to become superintendent of the Eastern division of the Alabama Power Company. Mr. Barry is a graduate of the electrical engineering department of the University of California with the class of 1910 and a young engineer of unusual promise. The Alabama Power Company is not only one of the greatest institutions of its kind in the South but ranks well up among the central stations of the nation. Typical of the chain of steam and hydroelectric plants operated by this company is that on the Coosa River, 50 miles south of Birmingham, with an initial installation of 70,000 h.p., provision being made for a further installation of 35,000 h.p. Men of the electrical industry in the West will follow Mr. Barry's career in the South with unusual interest as he will undoubtedly carry with him many of the traditions in hydroelectric practice now so efficiently in vogue in the West.

H. H. Daley of the Pacific States Company of San Francisco has gone to Los Angeles for a visit of several weeks.

F. N. Averill, president and manager of the Febes Supply Company of Portland, is recovering from an attack of tonsilitis and quinzy.

Chas. Chestnut resigned as sales manager of the Western Electric Company at Seattle, his duties being assumed by Frank Cooley.

George L. Oman, vice-president of the Pacific States Electric Company, headquarters Portland, Oregon, visited the Seattle office of the company recently.

Elmer Dover, manager of the Tacoma Gas Company and chairman of the Liberty Loan and United War Work campaigns, has been a recent San Francisco visitor.

W. Brewster Hall, district sales manager of Pass & Seymour Company, is making his regular semi-annual trip to the Pacific Coast and expects to be in California until the end of November.

J. H. Sroufe, of the Jaggar-Sroufe Company, and H. C. Packard, of the Beaver Electric Company, are among the Portland men who have suffered from the influenza but both are expected to be out in a short time.

Victor Cooley, well known among younger engineering circles on the Pacific Coast, is reported as having charge of all the telephones connecting the naval air stations and United States Headquarters in France.

E. D. Farrow, Jr., general agent of the San Joaquin Light and Power Corporation and manager of the Bakersfield district, has left for Camp Zachary Taylor, Louisville, Ky., to attend the officers' training camp for light artillery.

S. C. Jaggar of the Jaggar-Sroufe Company of Portland, Ore., recently returned home from his trip to Toronto, Canada, where he went to attend the meeting of the executive committee of the National Association of Electrical Contractors and Dealers. This committee did not hold any public meetings on account of the ban against holding meetings in that place, as the influenza is prevalent there.

F. H. Shephard, Director of Traffic, Westinghouse Electric & Manufacturing Company, New York, spent a week in Seattle and vicinity recently in connection with the main line electrification of the Chicago, Milwaukee & St. Paul Railway Cascade Division.

J. P. Pulliam, vice-president of the Eastern Oregon Light and Power Company, was a recent visitor in Baker where he attended a meeting of the stockholders and directors, but has left again via Portland and Seattle for his home in Milwaukee, Wis.

General Electric Company, having in charge the applications of the electric motor drive in the oil fields, is now general

S. G. Gassaway, for many years associated with the manager of the Electric Dehydrating Company with headquarters in San Francisco.

Max Thelen, formerly president of the California Railroad Commission, has been appointed representative of the War Department on the recently established Munitions Patent Board, for the purpose of coordinating the policies of the War Department and the Navy Department in patent matters.

Clyde B. Aitchison, formerly chairman of the Oregon public service commission and now at Washington, D. C., has had a trying experience during the influenza epidemic. Unable to get either doctor or nurse, his wife and son ill and himself with a lighter attack of the influenza, he took entire care of the family for three days until friends found them and volunteered their services. All recovered from the disease.

R. E. Fisher, assistant manager of the commercial department of the Pacific Gas and Electric Company, is recovering from an unusually severe attack of the influenza. Mr. Fisher's excellent work as recent president of the San Francisco Electrical Development League is still in the minds of the men of the industry in and about the San Francisco Bay region and all rejoice in the anticipation of his early recovery.

J. P. Lottridge has been elected manager of the Eastern Oregon Light and Power Company to succeed the late Frank A. Harmon. He is also to serve as secretary and assistant treasurer. Mr. Lottridge has been the auditor of the company for the past three years and acted as assistant manager during the illness of Mr. Harmon and since his death. J. W. Wilson, Jr. was also appointed auditor, while A. H. Kellogg was re-appointed superintendent.

Arthur F. Kelly, formerly a valuation engineer in San Francisco, has entered the service as a Captain in the engineer reserve corps. Mr. Kelly will be associated with Major George F. Sever, who as previously announced in these columns, is now undertaking a survey of the western power situation for the War Industries Board.

Captain W. J. Conway, secretary of the British Columbia Electrical Contractors and Dealers' Association, and B. F. Letts, a prominent contractor-dealer of Vancouver, were both interested visitors at the recent convention of the Oregon Association of Electrical Contractors and Dealers which met at Portland. Capt. Conway, shown at the left in the picture, is making his influence felt in British Columbia where his live and energetic association is forging ahead in advancement of individual interests of the membership and in helpfulness to the industry at large. The best wishes of the Pacific Coast States of America are heard on all sides for the continued progress of our Canadian cousins to the north.

R. D. Holabird and **H .H. Hoxie** of the Holabird Electric Company, with headquarters in San Francisco, have left for a business trip to the East, covering a period of six weeks.

Arthur B. Coates has resigned the position of instructor in mechanical engineering at the University of Idaho, Moscow, Idaho, and has become connected with the experimental engineering department of the Ford Motor Company, Detroit, Mich.

C. M. Guess, a consulting engineer of Los Angeles, together with his wife reported killed in the Russian revolution, has reached San Francisco after spending six months' time and more than 50,000 rubles fighting his way through Bolsheviki-controlled territory from the Baku oil fields of Russia.

E. N. Twogood, formerly of California, is living in Scotia, N. Y., where he is engaged in war work as engineer in the Ship Propulsion Division of the Turbine Engineering Department of the General Electric Company, making geared and electric turbine-driven units for cargo boats and transports to "put the boys across."

R. B. Benjamin, president of the Benjamin Electric Manufacturing Company is in San Francisco on business in connection with his company and **Miles Steel**, Pacific Coast representative of the company, is also in town, having recently returned from the East by way of Seattle where he was laid up for a while with influenza.

Capt. Harry A. Klugel, formerly chief engineer of the Mt. Whitney Power and Light Company, and more recently assistant to Major John Coffee Hays in the Utility Department of Camp Lewis, has been transferred to Camp Fremont where he is to be in charge of construction. It is not stated what construction work is contemplated.

Frank J. Quinn announces the severing of his connection with the Manhattan Electrical Supply Company on November 1, 1918. Announcement of new business connections that Mr. Quinn may make in the near future will be watched with unusual expectancy by the industry in the West, for his commercial efforts have been long and favorably known throughout this section. He is a brother of E. A. Quinn, chief engineer of the San Joaquin Light & Power Corporation.

T. D. MacMullen, formerly assistant manager of the Majestic Electric Development Company, has been appointed sales manager of the company with headquarters in San Francisco. Mr. MacMullen retains the direction of all his former duties. His company, manufacturers of electric heaters, dental and surgical appliances, reports that it is far over-sold on the season's business and foresees an enormous after-the-war trade.

F. C. Green, of Portland, has been appointed chairman of the housing committee of the Oregon Contractors and Dealers' Association, and is delegated to cooperate with the central housing committee so that the electrical installations in the proposed two thousand homes to be built in Portland for war workers may be at the lowest possible cost consistent with first-class workmanship and material. The other members of the committee are **F. A. Bauman, C. P. Scott, E. W. Pierce** and **J. R. Tomlinson.**

Henry L. Gray, engineer, formerly employed by the State Public Service Commission of Washington, has been added to the list of experts checking the property of the Puget Sound Traction, Light & Power Company in Seattle for the city. His portion of the task consists in endeavoring to disclose how much real estate owned by the company belongs to the power division and how much is strictly street car operating property. The question of the division of the real estate is one of the obstacles delaying the close of the deal.

James B. Smith, president of the King Coal Company has been appointed bunker representative for California of the United States Fuel Administration. The appointment was announced by **S. L. Yerkes**, assistant director of the distribution division of the Fuel Administration, who is in San Francisco on an inspection tour. Mr. Smith will be in charge of getting the coal for the expeditious bunkering of the great fleet of steamships that come to San Francisco, San Diego, San Pedro and other California harbors from all parts of the world.

Willis H. Booth, chairman of the board, Edison Electric Appliance Company, and one of the founders of the "Hot Point" appliances, has again added to his long list of honors and responsibilities. Mr. Booth leaves the Security Trust and Savings Bank of Los Angeles on January 1, 1919, where he is now engaged, to become vice-president of the Guaranty Fund Company of New York City. Mr. Booth has been a party candidate for United States Senator. He has long been recognized as one of the potent influences for good in the upbuilding of the West.

Kojiro Matsukata, president of the Kawasaki Dockyard Company, Ltd., the largest shipbuilders in Japan and referred to by the local Japanese colony as the "Henry Ford of Japan" because of his industrial policies of high wages and quantity production, is in San Francisco, on his way home after two and a half years in England in the interests of his company. Strikes have hampered every other large shipbuilding plant in Japan but the Kawasaki yard, which holds several records for speedy construction, has been exempt. Masukata is also president of the Kobe Pier Company, the Imperial Marine Products Company, the Nada Commercial Bank and the Toa Cement Company. He is director in several other large Japanese industries.

J. M. Wadsworth, state administrative engineer for the federal fuel administration for California, has appointed the following engineers to assist in the work of fuel conservation in California: Earl Wagy, C. P. Bowie, Advisory Engineers on Special Investigation, Petroleum Engineers for the United States Bureau of Mines. L. H. Cochran, Advisory Engineer Power Plant Inspection Los Angeles County, Engineer, R. B. Guernsey and Company. A. A. Coddington, Advisory Engineer Power Plant Inspection, San Francisco County and Marin County, of the firm of Morrin and Coddington, Consulting Mechanical Engineers. Arthur G. Caldwell, Advisory Engineer, Hotel and Apartment House heating plants, San Francisco, Engineer, Johnson Service Company. Clyde Swigart, Advisory Engineer, Power Plant Inspection, Kern County, Standard Oil Company, Assistant to J. J. Wilt, Supt. Steam Pipe Line. J. C. Martin, Advisory Engineer, Steam Railways, General Manager, Aetna Combustion Company.

OBITUARY

Frank I. Parker of The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., died at his home in Milwaukee on October 18th, at the age of 36 years. His death was due to pneumonia contracted through influenza. Since 1911 Mr. Parker has had charge of the Sales Service work on clutch department products.

C. A. Waring, geologist and member of the State Mining Bureau, died within the last two weeks as a result of pneumonia following an attack of influenza. Waring was a graduate of Stanford University of the class of 1911, having been especially active in the Sigma Xi scientific honor society.

Charles G. Roebling, president of John A. Roebling's Sons Co., wire manufacturers, passed away October 5th at his home in Trenton, N. J., at the age of 69 years. Mr. Roebling was probably best known in connection with the construction of the Brooklyn bridge which he and his brother, Washington A. Roebling, completed on the death of their father.

J. W. Leighton, Seattle manager of the National Carbon Company, died of peritonitis at his Seattle home on October 24, 1918.

MEETING NOTICES FOR ELECTRICAL MEN

(A new contractor-dealers' association formed in Sacramento, a jobbers' convention called at Del Monte and general plans for winter progress mark the revival of interest in electrical associations with the lessening of the epidemic. Matters are still very slow, however, and it promises to be some time before the ban is lifted.—The Editor.)

Northern California Electrical Contractors Meet

On the evening of Oct. 12th electrical contractors of the upper Sacramento Valley met at Marysville and took preliminary steps towards the formation of a Sacramento section of the California Association of Electrical Contractors and Dealers. Those present were: Doran Russell, Colusa; W. H. Gribble, Chico; W. S. Cass, Chico; Henry Berg, Marysville; and G. A. Dahlmaier, Oroville.

W. H. Gribble was elected president of the newly formed section, and H. Berg as secretary. M. A. de Lew, president-elect of the State Association, was present, and set before the attendance at the meeting the opportunity afforded for cooperation work through association efforts. W. F. Brainard, field representative of the California Electrical Cooperative Campaign, through whose efforts the meeting was called, was also present and explained the working of the campaign.

Pacific Division, Electric Supply Jobbers' Association

In spite of the fact that Albert Elliot, who has so long and so punctiliously observed the spelling of his name with a single "t," nevertheless now comes forth with his stationery and signature spelled "Albert H. Elliott," still there is life and action in his announcement of the forthcoming meeting ing of the Pacific Division of the Electric Supply Jobbers' Association at Del Monte, provisionally set for December 5, 6, and 7, as follows:

Dear Sir:

The "Flu" being willing, the next meeting of the Pacific Division, E. S. J. A., will be held, time and place above specified. You are invited to doff your mask, don your golf clothes, inflate your lungs with spiritus Associatoni and come. Now that we have pushed the "Flu" germs and the Kaiser into the same hot place, let us peaceably assemble to discuss our past, to survey our present and to prepare for our future—electrically, of course.

Answer only if you are coming, but your absence will cost you more than a three-cent stamp. Very truly,

ALBERT H. ELLIOTT, Secretary.

N. E. L. A. Committee

W. F. Wells, president of the N. E. L. A., announces the Committee on Reorganization of Geographical Sections to consist of—

Samuel Insull, Chairman — Commonwealth-Edison Co., Chicago, Ill.

Charles L. Edgar—Edison Elec. Ill'g. Co., Boston.

J. B. McCall—Phila. Electric Co., Philadelphia.

R. H. Ballard—South. Cal. Edison Co., Los Angeles.

J. A. Britton—Pacific Gas & Electric Co. San Francisco.

Portland Local Association of Electrical Contractors and Dealers

Owing to the local ordinance against the holding of gatherings at this time, all meetings of the association are indefinitely postponed. Members will be notified in due course of the resumption of meetings.

Associated Engineering Societies of Seattle

Robert Howes, president of the Associated Engineering Societies of Seattle in cooperation with American Engineering Service of Engineering Council, 29 West Thirty-ninth street, New York, is sending out a personal classification sheet to members of the society with a view to a comprehensive registration. The importance of the profession has been emphasized and it is a worthy service that assists in placing most fittingly those devoting their knowledge and experience in whole or in part to the nation's requirements, not only during the war but in the reconstruction period to follow. Engineers are requested to fill out the blanks fully and carefully, whether they consider themselves permanently situated or otherwise, as such information may lead to the benefit of the engineers as well as the government or others desiring the services of engineers with special qualifications. Two copies should be mailed to the secretary of the Associated Engineering Societies, 445 Henry Building, Seattle, and a third copy retained.

Seattle Engineers' Club

A special meeting was called October 10th at the Engineers' Club in their quarters, 404 Arctic Building, at which time they were to have been addressed by E. J. Mehren, editor of the Engineering News-Record, New York City. Owing to the ban on public gatherings, the program had to be dispensed with and the meeting called off.

BUILDERS OF THE WEST—XL

A. C. BALCH

Among the noted "Builders of the West" whose names appear in the latest edition of "Who's Who in America" there is none more distinguished than that of A. C. Balch, vice-president of the San Joaquin Light & Power Corporation. Since 1889 as an electrical engineer his influence has been felt in the West. But for his unique service in harnessing the natural gas resources of California for lighting supply and steam power generation the West must ever grant to him a deep sense of gratitude, and to him this issue of the Journal of Electricity is dedicated as a lasting memorial to this service in the West.

Annual Meeting A. S. M. E.

Plans for the Annual Meeting, to be held December 3-6, 1918, have so far developed that tentative announcement of several of the sessions can now be made. The practice in previous years of having a leading subject for the meeting of broad, general interest, will be adhered to, with a discussion throughout the day on Wednesday, December 4th, of the general topic on Human Engineering, particularly in reference to questions of administration which have arisen in the war industries. The titles of the papers now in preparation for this session are as follows: Organization; Standardization and Administration of Wages; Non-Financial Incentives; Incentive of Control in Industry; Employment of Labor; Dilution of Labor; Intensive Training; Human Relations in Industry.

There will be at least two sessions for general papers of technical interest for which an ample variety of strong contributions have been received.

One session will be under the auspices of the Gas Power Sub-Committee with papers on oil engines and cooling losses in combustion engines. Another session will be in charge of the Sub-Committee on Textiles, with papers on industrial power problems and aeroplane fabrics. A session arranged by the Sub-Committee on Machine Shop Practice will be devoted to the subject of gages, methods of manufacture and testing. The apparatus in the Department of the Bureau of Standards, located in the Engineering Societies Building, New York, will be added to with a view to placing the equipment on exhibition during the meeting.

Another session will be a joint meeting with the American Society of Refrigerating Engineers, which holds its annual convention simultaneously with that of our own society. Papers will be contributed by both societies.

A RECONSTRUCTION CONFERENCE

Preliminary plans for the War Emergency and Reconstruction Conference of War Service Committees to be held at Atlantic City, December 4, 5 and 6, are announced by the Chamber of Commerce of the United States.

Reconstruction will be given a prominent place on the program, as it is recognized this subject must be taken up by business men to the end that there may be placed at the command of the government all available sources of information. The work of reconstruction suggests the creation of a federation of all war service committees that whatever study and planning is carried on may be on behalf of all business. War industries and non-war industries are concerned equally in the determination of reconstruction problems. All European countries already are under way with reconstruction plans.

The Atlantic City conference, a call for which has been sent out by the War Service Executive Committee of the Chamber of Commerce of the United States, will include four general sessions and numerous groups and committee meetings. Into the final session will be brought for final action all the proceedings of the meetings.

There will be four general sessions participated in by all the delegates. On December 4th there will be both morning and afternoon sessions and on the 5th and 6th morning sessions. The Chamber is engaged now in obtaining the best speakers available to discuss among others the following suggestions: Reconstruction; industrial relation; raw materials and their control; price control; economic legislation affecting combinations; export and import operations; finance, etc.

The conference will be divided into groups at three sessions, the first to be held on the evening of December 4th, the second on the afternoon of December 5th, and the third on the evening of the same day. On the evening of December 4th each war service committee will meet with its chairman to consider the problems of reconstruction as they affect that particular industry as well as to take up other problems which the war has demonstrated are vital to industry. On the afternoon of December 5th the war service committees will meet in groups which are related as to their use of basic materials and as to their distribution problems, etc. With these groups will meet the commodity or section chiefs of the War Industries Board. Related groups will form themselves into ten major groups on the evening of December 5th to take up the question of raw materials, price control and subjects arising from related group meetings. After the general meetings of the committees of the related groups and of the major groups it is hoped there will be presented definite recommendations covering the reconstruction period, with the possibility of creating an executive committee empowered to gather data and to function with industries to meet the many problems that the nation's industries will be called upon to solve with the end of the war.

HAPPENINGS IN THE INDUSTRY

INQUIRIES ON PRIORITIES QUESTIONS

The Priorities Committee announces that it undertakes where necessary to administer priority in the production of all raw materials and finished products save foods, feeds, and fuel. The preference list promulgated by the Priorities Board forms the basis for the distribution of fuel. Priority is being administered generally on iron and steel products, copper and brass products, electrical equipment, and the products of which any of the above form an integral part. Priority is not being administered at this time on lumber products, paper or paper products, chemicals, brick, cement, lime, hides, pig tin, tin plate, mine products, and numerous other items which cannot well be enumerated. It is not possible to prepare lists in detail covering either prioritied or non-prioritied products, and even in those mentioned above exceptions will from time to time occur. Any inquiries with respect to the commodities upon which priority is being administered should be addressed to the Priorities Committee of the War Industries Board.

CONSERVATION LIGHTING ADVERTISING COPY FOR CENTRAL STATIONS

Much interest centers in the recent recommendation of the National Committee on Gas and Electric Service made to the central stations of the country, recommending the curtailment wherever and whenever possible of all needless lighting. In this connection the Society for Electrical Development has prepared the copy and made the necessary drawings to illustrate the text for advertising for the use of the central stations and others interested in the distribution of lamps, to be used in furtherance of the Fuel Administration's program. The drawings are the work of foremost New York pen-and-ink artists and arrangements have been made by the society to supply all central station companies with "mats" of the cuts for each advertisement at a charge of five cents each.

JITNEYS HELD NON-ESSENTIAL

The Hoquiam, Washington, city council has put a non-essential ban on jitneys. It has refused to issue licenses to jitney drivers who do not work at least eight hours per day in a shipyard or lumber mill or in some other essential industry. The commission has also announced that renouncement of first citizenship papers to avoid being called in the army draft shall be an absolute disqualification and such men will not be allowed jitney licenses. Most of the jitneys in the city have been operated by foreigners.

ELECTRIC TRAINS TO SEATTLE BY JULY 1

H. E. Byram, federal director of the Milwaukee railroad, who recently reached Seattle, declares that the first electric Milwaukee train should reach Seattle July 1st of next year unless unforeseen delay occurs. He was accompanied in his trip of inspection over the Milwaukee lines by C. F. Loweth, chief engineer, G. L. Whipple, superintendent of transportation, and E. M. Penfield, engineer of maintenance. The work of electrifying the line from eastern Washington to Puget Sound is progressing favorably. Poles are being set up, wires are being strung and work on substations and other buildings is going forward at a good rate in spite of the unavoidable delay in procuring material. The electrification begins at Othello in eastern Washington and ends at Tacoma, covering a distance of 220 miles. This, with the electrical system 440 miles long through the Rocky mountains, will give the Milwaukee a total of 660 miles of electric railroad.

SEATTLE VOTES TO BUY STREET CAR LINES

The city of Seattle has voted to purchase the street railway system of the Puget Sound Traction, Light & Power Company for the sum of $15,000,000, the vote standing about four to one in favor of the purchase. The council will now proceed to close the deal as quickly as possible and but little difficulty is expected. The council will also immediately take up the question of the purchase of the Seattle & Rainier Valley Railway lines, including the Renton interurban. The company has offered this property to the city at $1,600,000. The purchase of this property was included in the general scheme for a municipally owned street railway system. Closing the traction deal makes available a loan of $339,000 from the government to complete the elevated line to the west side and pay for the 25 new cars recently purchased by the city.

A statement prepared at the city hall, Seattle, for the information of the public concerning the value of the street railway system of the Puget Sound Traction, Light & Power Company which the city proposes to buy for the sum of $15,000,000 in utility bonds shows the following:

206 miles of street railway track and overhead system	$11,683,966.06
540 street cars	2,500,000.00
81 pieces of real estate	540,000.00
Buildings, car barns, shops and freight sheds	528,980.00
Machinery, tools and equipment	500,000.00
Stock, including electrical supplies	350,000.00
Total value	$16,102,946.06

On October 20th it was estimated by the mayor that it would require 60 days more time to close the deal with the company, in the meantime question of the purchase being put up to the voters of the city on November 5th.

GOVERNMENT POSITIONS

Radio Operators for Merchant Marine —

Scarcity of radio operators is reported from Portland. Government requirements must be met as regards wireless equipment and in Portland is found a dearth of men qualified to fill the positions. So far none of the new vessels sailing from that port has been delayed, but several ships just about to leave have secured no wireless operators.

Charles L. Austin, United States radio inspector, is issuing an appeal to all radio men with sea experience or who can pass the examinations qualifying them for sea service, to make application at once for this work, either to his office on the fifth floor of the Northwestern Bank Building, Portland, or to Lieutenant Harold C. Jones, head of the sea service bureau.

Women Telephone Operators for France —

The University of California Military Bureau has announced that a limited number of women are needed at once to serve as telephone operators with the American Expeditionary Force in France. Successful applicants must be physically fit and must speak the English and French languages fluently. Experience in telephone switchboard operating is advantageous but not absolutely necessary. Applicants may secure blanks and further information at the office of the Military Bureau, at the University at Berkeley.

FUEL SAVING BY INDUSTRIAL PLANTS

Through the cooperation of the industrial power plants, which have thus far put into force the standard recommendations of the United States Fuel Administration to promote efficiency in the use of fuel in power plants, a saving of seven million tons annually has been effected. That is to say, in the first six months from the announcement of the National program, three and one-half million tons have been conserved, at the same time maintaining maximum production in the factories.

Some industrial plants which have adopted the standard recommendations and kept systematic records report a fuel saving as high as 25%, and the average is estimated between 10% and 15%. This large economy is effected at practically no expense to the plant owner since the recommendations treat primarily of proper methods of firing and management in power plants.

The Fuel Administration campaign comprehends voluntary service by engineer inspectors, lectures to fuel conservation classes in educational institutions, addresses before public meetings, explanations of the program to power plant owners, and various forms of printed matter and posters.

GROWTH OF INDUSTRY IN JAPAN

As the result of the shrinkage in the importations of machinery from Europe and America, the makers in Japan have been extraordinarily busy. According to the report of the Department of Agriculture and Commerce the recent number of machine shops is 1593, number of workmen 131,500, and the total production of last year 360,000,000 yen ($180,000,000). The production of last year is more than double that before the war.

AN OIL WELL IN SAN FRANCISCO

About the first of October, the California State Board of Harbor Commissioners began an excavation for a reinforced concrete storage tank on a lot at the corner of Battery street and the Embarcadero, San Francisco. As this is filled land and only about 200 feet west of the San Francisco sea wall, it is usual to strike water at a depth of about six feet. Accordingly when the excavation neared this depth, a small centrifugal pump was installed to take care of the water. After the pump had been in operation for a few hours the foreman of the job was much surprised to find that the pump was delivering a stream of almost straight oil, and a great deal of excitement was created along the water front. Reports went broadcast that the State Board of Harbor Commissioners had brought in an oil well almost in the heart of San Francisco. About the same time, some workmen engaged on work for the state in excavating for concrete piles, about four blocks north, also struck a small amount of oil. This increased the excitement and repeated inquiries came to the office of the U. S. Bureau of Mines in the Custom House for an explanation of the occurrence of oil in paying quantities in San Francisco.

The matter has been investigated by one of the members of the Bureau, and it has been found that all the claims made for the discovery of oil at the corner of Battery and the Embarcadero in paying quantities are true. For the first four days after the oil was discovered, it was being pumped from the excavation at the rate of about 120 barrels per day, and since that time approximately 1500 barrels of oil have been recovered. The oil has a gravity of 18 degrees B., and is now being used in the locomotives of the State Belt Line.

Investigation has shown that at the time of the fire and earthquake in 1906, there were several large oil storage tanks about five blocks north of the point where the excavation was made. These tanks were all on filled ground. At least one of them, which is said to have had a capacity of 37,000 barrels, was ruptured at the time of the earthquake by the ground settling under it, and a large amount of the contents presumably seeped in the porous fill, which was composed largely of brickbats, rubbish, rock, etc., before the fire reached this point about two days later. Undoubtedly, this is the oil which is now being recovered.

The instance is worthy of note in that it tends to show in a measure the action of water on oil in underground strata. The sea wall running along the easterly line of the Embarcadero has kept the oil from getting out on the bay. The solid formation of Russian Hill to the west has kept it from traveling in that direction, and tide water has kept it from going down, so its migrations are limited to a comparatively narrow strip in the vicinity of the Embarcadero. The bulk of it, no doubt, collected in the more porous parts of the filled ground, from which a large per cent of the total amount lost will probably be recovered from time to time as building excavations are made in that vicinity.

POWER SITUATION IN CALIFORNIA

Recent storms have solved the hydroelectric power problems for California until the beginning of the low-water reserve toward the end of next summer. Two feet of snow has fallen in the Sierra in the past few days, with a heavy run-off into the streams used for power purposes.

The influenza epidemic is having a slight effect in lessening the load on the power companies through the closing of schools, theaters and churches, but this was practically offset by the change in time on October 27. As a result of this the power and lighting loads were overlapping to some extent.

TRADE NOTES

Offices Moved —

The Perkins Electric Equipment and the Stewart Fuller Company of San Francisco have moved to 589 Howard street.

Change of Address —

The Butte Engineering and Electric Company with headquarters in San Francisco has moved from its old location at 683 Howard street to 530 Folsom street, near Second, where greatly enlarged facilities will enable the company to attend to its growing electrical contracting business. Visitors will be welcomed to go through the plant at any and all times.

Electric Dredge at Port Angeles —

F. D. Nims, 620 New York Building, Seattle, vice-president Washington Coast Utilities, Northwest Electric and Waterworks, Vashon Light and Power Company and assistant manager and engineer for the Northwestern Power and Manufacturing Company, reports much activity among the concerns he represents on the Olympic Peninsula. At Port Angeles, Washington, the Tacoma Dredging Company has a contract for dredging and filling for the government spruce mill being erected there by the Siems-Carey H. S. Kerbaugh Company. The electric dredge is being fed by a submarine cable, the current supplied from the hydroelectric plant of the Northwestern Power & Manufacturing Company near Port Angeles. The latter company is also conducting sluicing operations above the Elwha dam to stop the seepage and has made satisfactory progress, the seepage having been greatly diminished.

New Business —

C. H. E. Williams & Company, electrical engineers and contractors, 705 Securities Building, Seattle, J. R. Barry, manager, report among other activities a contract for the electrical installations in ten 9400-ton steel ships for the Seattle, North Pacific Shipbuilding Company. The company has the contract for installing the lighting and power equipment in the large wireless plant of the Kilbourne & Clark Manufacturing Company at the corner of East Marginal Way and Spokane street, Seattle, and is also doing a similar work in the salmon warehouse of the Port of Seattle Commission, as well as finishing the electrical installations in the naval training camp at the University of Washington.

Service Record —

With fifty-seven service stars in their flag, the Pacific States Electric Company is taking particular part in the victory celebration. The men in the service come from every department of the company, and though for the most part they left subordinate positions, their loss has been deeply felt. It has been a substitution of service to the government for some of the refinements of extra service to customers—but the loss is gladly met by the organization and patrons alike.

A New Vice-President —

Announcement is made of the election of Charles C. Du Bois as vice-president of the Western Electric Company, Incorporated. Mr. Du Bois entered the employ of the company in 1891 at its New York office, and occupied successively the positions of Chief Clerk, Secretary and Supervisor of Branch Houses. In 1907 he became Comptroller of The American Telephone and Telegraph Company and in this capacity inaugurated and supervised a comprehensive system of accounting for the Bell Telephone System. During the winter of 1917-1918 Mr. Du Bois was in Washington in the capacity of Comptroller of the American Red Cross, which position he still retains.

LETTERS FROM THE FRONT

Howard Scott, formerly in the electrical business in Astoria, Ore., now first class electrician in the navy, recently arrived in Portland on his way home on sick leave. He wears in addition to his French Croix de Guerre and the gold stripe showing service in the war zone, a gold wound stripe. He went through the fight in Belleau Wood near Chateau Thierry where he was gassed and shell shocked. He says of his experiences:—

"It was 3 o'clock in the morning of July 28 that I received my wounds. We were stationed near Chateau-Thierry, at the farthest point of the German advance toward Paris—about 48 miles from that city. Sniping was going on in the partially evacuated town, the shots coming from the tower of a brick church. Men were sent up to investigate; they never came back. Others were sent up, but failed to return. Then the naval batteries were phoned to and instructed to blow up the church.

"We were six miles away, but by using a searchlight of 1800 amperes which I, as first-class gun-pointer, operated, the batteries obtained the range. Three shots were fired upon the church. When we looked we saw—a brickyard. Later we were told several hundred Germans perished in the building. But the enemy secured our range at the same time and of the 25 men on duty but eight were left to tell the story. Seventeen were unaccounted for; five were badly gassed. The last thing I remember is that I smelled garlic, which was the mustard gas. I received only a slight touch of the poison, or I would have perished, for I was 18 hours without medical attention."

H. V. Linkens, formerly of the Pacific Telephone & Telegraph Company and now Lieutenant in the Marine Service on the staff of Admiral Sims, writes of his experiences with the telephone systems in Ireland, as quoted in the Pacific Telephone Magazine: "I have had considerable dealings with the telephone authorities here who, by the way, are the post-office people. I was very much surprised to learn how far behind the times communications are over here, that is, from a land wire standpoint. They do not put much faith in loaded circuits, and to the best of my knowledge there is on one in use, and I am sure all the coils are magnetized. Incidentally, they use lump loading, which usually is located in a span between the poles. As for transpositions, they are rarely seen, and in no place do they use circuit heavier than 150 pounds. Consequently it was quite impossible to talk from the northern to the southern part of Ireland until one of our circuits was constructed, using heavy copper and eliminating cable and central office losses where possible, thanks to my early training with the Pacific Company. Land wire work, however, is a small portion of my duties, as the radio end of it now takes up most of my time, since the land wire work has been completed. Within the last month or so, since I have developed a fairly good communication organization, I have been made aide for military operations. Of this I am also unable to tell you much. As military operations largely depend on communications, they work together nicely. Military operations lay out all seaplane patrol areas, trying to cover the track of the submarines from the time they leave the German coast for operation in these waters. You would be very much surprised to see how this is done, but it is quite possible to track them from the time they leave the German base until the time they start on their return trip home, if they ever get there. This work is quite interesting and affords considerable excitement at times."

LATEST IN EVERYTHING ELECTRICAL

(A line of electrical devices for marine service of a standardized type are being developed to meet the needs of the growing merchant marine. A compact watthour meter has recently been put on the market of a new type similar in principle to those which have been used in navy submarines during the last two years. Other war uses of electric appliances and apparatus are noted.—The Editor.)

THREE-WIRE D-5 METERS

At the present time when great attention is being given to conservation and standardization, the new direct-current, 3-wire, service type watthour meter just placed on the market by the Sangamo Electric Company is attracting much attention.

This meter consists simply of 2 and 3-wire elements placed side by side in a common base and registering their kw-hr. on a common recording train so that the sum of the revolutions of the 2 elements will be properly added and indicated on the kw-hr. dial of the meter. This is effected by

Fig. 1—New Sangamo D.C. 3-wire meter

means of a very simple but ingenious differential gearing within the recording train so that no matter what load there may be on one element as compared with the other, the total revolutions of the two elements will be accurately added and recorded. Even with one element fully loaded and the other one without load, the registration is as accurate as though each element were recording on a separate train.

This arrangement of meter elements and train is not new, but has been given a thorough and successful test on similar ampere-hour meters built for use with storage batteries on submarine vessels of the U. S. Navy during the past

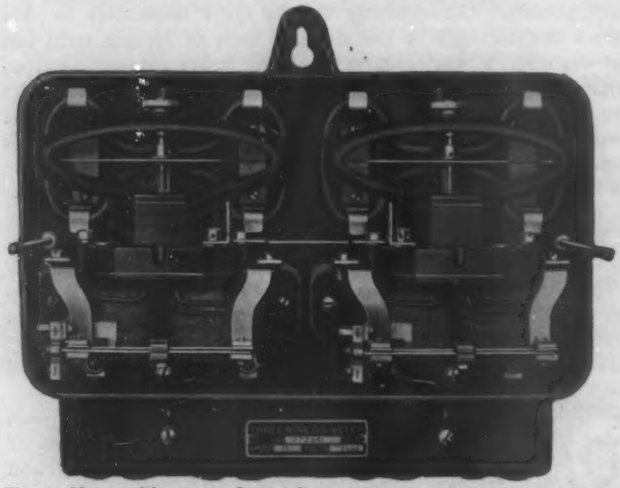


Fig. 2—Meter with case and recording train removed, showing two independent standard 2-wire motor elements

two years. The only difference between these very successful ampere-hour meters for submarines and the present 3-wire D-5 service type meter, is in the fact that the driving elements in the ampere-hour meters have permanent magnet fields instead of shunt energized fields of the watthour meter.

As will be seen from Fig. 2, each element of the new 3-wire meter is a standard 2-wire element including the light load adjustment, the arranging of damping magnets, and in the case of meters over 10 amperes capacity, the arrangement of internal or external shunts. As shown in diagram Fig. 3 and from the arrangement of the elements it will be apparent that this meter achieves for the first time the requirements of a true 3-wire direct current meter; that is, one which will measure and record accurately, the load on either side of a 3-wire distributing system, no matter whether the other side is entirely dead. For example, if the fuse in one outer line of the system is blown or purposely withdrawn, the element

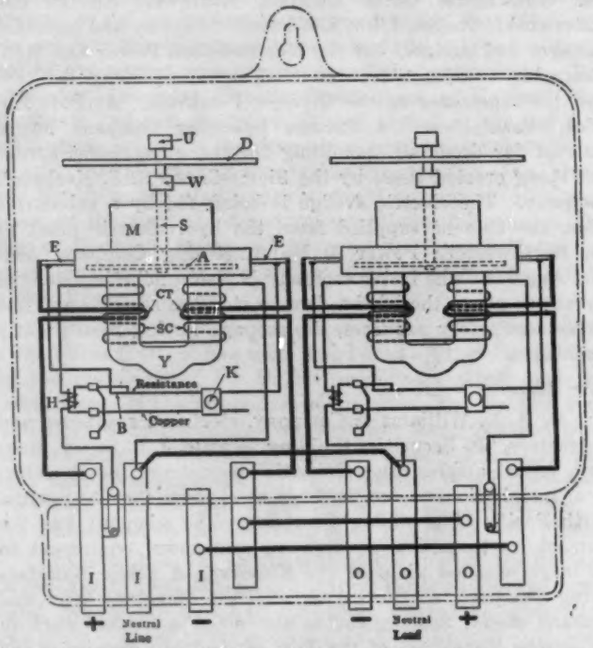


Fig. 3—Wiring diagram showing internal connections of the new Sangamo 3-wire D.C. meter

connected in the other side will record accurately the load on that side, as its potential circuit and measuring circuits are entirely independent of the side which is open. If the neutral fuse is blown or withdrawn the two potential elements remain in series across the outer lines so that the meter will continue to record any load that may pass through it between the outer wires with the neutral open. Under widely unbalanced conditions of voltage between the outer lines, this meter will record with a degree of accuracy which is impossible with any former 3-wire direct current meter having a single potential element connected either between one outer line and the neutral, or between the two outer wires. As shown in the diagram, the elements are so connected through an ingenious interchange of connections within the terminal box itself that the load wires from and to the line, pass in and out of the meter in regular succession; no crossing over or interchanging of leads being required.

The recording train is held on a bracket connecting the two motor elements, shown in Fig. 2 with the train removed, and absolutely correct meshing of the two worm wheels on the train, engaging with the two elements, is obtained by a system of locating rear bearings of the worm wheels similar to that used in the standard 2-wire meter. The train is held in position by a simple locking device operated from the top front so that it may be readily removed for purpose of inspection and calibration of the elements.

In calibrating, each new element is considered and tested as a standard 2-wire meter without respect to the other element. For this reason, an absolutely perfect balance of the two elements may be secured in minimum time and effort by the tester.

The meter when connected, occupies about the same space on the wall as an ordinary polyphase service type alternating current meter. This meter will be supplied in all capacities from the unshunted 10 ampere meter, to the largest externally shunted capacities.

ELECTRICAL DEVICES FOR MARINE SERVICE

Up to the time of the development of the large number of merchant boats under the jurisdiction of the Emergency Fleet Corporation, it had been common practice to adapt ordinary electrical wiring devices for use on commercial vessels. Standardization of ship design and manufacture consequently called for standardization of all necessary fittings. With the realization of this demand for standardized marine wiring devices, The Bryant Electric Company of Bridgeport, Conn., have developed after an exhaustive study of the specific requirements of the service, a line of sockets, switches, connecting blocks, and other devices which have been approved by the Emergency Fleet Corporation and which are, of course, National Electric Code approved. One of the inherent conditions of service existing in this class of electrical installation is the constant heavy vibration caused by the machinery operating the ship as well as the vibration usually received by craft sailing in open sea. As will be noted from the illustration accompanying, keyless receptacles, the base and all parts are made of unbreakable molded composition of liberal dimensions. There are grooves on the under side of the receptacle bases which permit of the convenient passing of separate circuit wires through the box. Double binding screw terminals are provided so that taps can be taken directly off the terminal plate without requiring the usual soldered connections in the box.

Keyless receptacle installed in 4-inch box, showing use of spare terminals to make branch circuit with no soldered connections

Another feature of importance which will be appreciated by the wiring contractor is the fact that all screw spacings for attaching the receptacles in the box are uniform; that is, one and three-eighths inches on centers. Round head brass machine screws 6-36 are provided for this purpose, the screws being retained in the holes in the receptacles by means of fibre washers. The diameter of the receptacles is one and three-quarter inches, and two of them can be mounted side by side in a four-inch round box if desired. The lamp receptacle shell insulator shown is designed to eliminate the danger of exposed metal parts where the requirements of the service necessitate. It is fitted and furnished as a separate piece. All metal parts are of brass or bronze with the exception of those elements which, because of their function, must necessarily be made of steel. Such parts as the ratchet plate, the escapement and the actuating music-wire spring while of steel, are heavily copper-plated to prevent rusting.

These types of devices were specified and are being used on the 3500-ton Ferris type of wooden ships for which the Government has contracted with various shipyards throughout the country.

ELECTRIC HEATING DEVICES FOR INDUSTRIAL PURPOSES

American Beauty electric soldering irons are being used in tremendous quantities in the manufacture, equipment, maintenance and repair of aeroplanes, submarines, munitions, guns, food containers, shells, motors, trucks, telegraph and telephone lines and equipment, radio apparatus and the thousand and one other articles necessary to keep our armies and navy in the field, because they do the work easier, quicker and better.

For light, medium or medium heavy soldering operations these electric soldering irons are ideal. With their use the hazard of fire is practically eliminated and because no noxious gases, fumes or flames attend their use, the health and comfort of the user is promoted. Also because these irons are self-heated and can be used anywhere that electric current is available the work can be done more quickly and better.

The irons are made on the unit plan. Each important part is a complete unit of itself, thus providing for quick and easy repairs, right on the job should same become necessary at any time. The tips are especially heat treated and do not readily corrode or oxydize and will last for a considerable length of time.

Besides electric soldering irons, electric glue pots, stoves, hot plates, air heaters and other devices are being used in rapidly increasing quantities because of their many inherent advantages.

It is well known that glue, in order to retain its sticking qualities, must be kept and applied at a certain temperature and that that temperature must be constantly the same. Glue that has been overheated rapidly deteriorates. Electric glue pots are particularly advantageous because with them there is no guess work. Their contents are automatically always kept at the same temperature, thus assuring the best and most economical results.

Electric air heaters are ideal for use in small, isolated buildings such as sentry houses, oil houses, scale houses, watchmen's houses and for places where chemicals or explosives are made or stored, and are rapidly coming into extended use for such purposes in and around industrial concerns of all kinds.

Government Bulletins

The Government Printing Office has issued Circular No. 72 of the Bureau of Standards, on the "Scope and Application of the National Electrical Safety Code." The publication discusses the need for the code and gives practical suggestions as to its application.

A study by O. S. Peters, Assistant Physicist for the Bureau of Standards, on "Ground Connections for Electrical Systems," has been published by the Department of Commerce as Circular No. 108. The important part which ground connections have come to play in recent years gives this publication an especial value.

BOOKS AND BULLETINS

Bureau of Mines Publications

The Bureau of Mines of the Department of the Interior publishes, in technical paper 205, an article by Henry Kreisinger on "Saving Coal in Boiler Plants." It is addressed to the fireman, the engineer, and the owner or manager of the power plant, and it tries to point out to them their responsibility for fuel-saving and to explain the most effective methods for accomplishing it.

Bulletin 123 of the Bureau of Mines, Department of the Interior, is the third of a series on the sampling and analysis of the coals of the country begun by the federal government in 1904. The present bulletin is entitled "Analysis of Mine and Car Samples of Coal Collection in the Fiscal Years 1913 to 1916." It is of no particular interest to the domestic consumer but industries that require large quantities of coal should find it invaluable.

Bulletins from the Manufacturers

The Cooley Manufacturing Company of Seattle, Washington, has prepared a catalogue of "Marine Electrical Fixtures, Marine Wiring Fittings, Watertight Fittings and Watertight Appliances for Electrical Construction on Ships." The catalogue is carefully organized and should be of value to the shipbuilding industry and of great assistance in specifying and buying electrical materials for ships.

The Anderson Electric Specialty Company of Chicago has issued a little illustrated pamphlet about their patent "Autoreelite." It explains the triple value of the lamp as a spot-light, a trouble-light and a pleasure-light.

Bulletin No. 48938 of the Sprague Electrical Works, General Electric Company, gives a very complete exposition of the operation and the various uses of the electric grab-bucket hoists.

Efficiency in the Use of Oil Fuel

This pamphlet of 86 pages is intended as a handbook of information for the man intimately associated with the use of oil fuel. It has been compiled by the Bureau of Mines, from its own investigations and from leading authorities, in cooperation with the United States Fuel Administration. The emergencies of the war have brought before the public with startling directness the need for greater efficiency in the utilization of our mineral resources. As users of fuel oil have shown a lively interest in helping to save fuel, the Bureau of Mines believes that an educational campaign to develop methods for eliminating waste will receive their heartiest support. Such work, fostered primarily as a war measure, must prove a permanent and lasting benefit to the petroleum industry and to the nation.

In 1917 there were 160,000,000 barrels of fuel oil burned in the United States. At a conservative estimate 40,000,000 barrels, or one-fourth of the total, might have been saved by more intelligent operation of plants and by proper firing. Therefore all users of oil fuel are urged to take steps immediately to reduce their fuel consumption by carefully observing the principles stated in this pamphlet and by recognizing the value of engineering advice in the design and operation of their plants.

The author, Mr. J. M. Wadsworth, is now acting as administrative engineer for the Federal Fuel Administration for California. The booklet is timely and should find wide application throughout the West where oil is used as a fuel. It may be received free of charge by addressing the California Federal Fuel Administration, First National Bank Building, San Francisco.

McGraw Central Station List—1918

By McGraw-Hill Company, Inc.; 1918 edition; size 4½ by 8½ in.; 797 pp.; published by McGraw-Hill Company, New York, and for sale by the Technical Book Shop, San Francisco. Price $15.00.

This book contains an authoritative list of central stations arranged by states and cities, giving statistics showing the total number of private and municipal plants, companies selling supplies, companies having day service, and much valuable physical data connected with power plant and central station installations, including a list of company executives and the man who has the purchasing for each company. In the rear of the book is a list of state commissions having jurisdiction over electric light and power utilities, followed by an index to central stations whose names do not indicate their location.

The real work involved in preparation of the Central Station List is tremendous. Few persons realize the immensity of the task. This year so many thousand changes were reported that the work involved was unusually difficult and trying.

This new publication—the 1918 edition—like its predecessors may well be considered the standard reference of its kind for use in the electrical industry. To all branches of the industry—the manufacturer, the jobber, the contractor-dealer and the central station—its service will be found invaluable.

Who's Who in America (1918-19 Edition)

By A. N. Marquis; size 6 by 8 in.; 3176 pp.; published by A. N. Marquis & Company, Chicago and for sale by the Technical Book Shop, San Francisco. Price $6.00.

Western men will be particularly interested in perusing the pages of the tenth edition of Who's Who in America, which is just off the press. It contains a vast amount of information not only concerning prominent engineers, executives and educators of the East of interest to men of the electrical industry, but as an instance of the growing prominence of men of this industry in the West in their relation to the national status, the 1918-19 edition above alluded to is especially illuminating. Taken at random from its pages the reader will gather some conception of this growing prominence of western men by scanning the following partial list of biographies that appear in this new edition:

John D. Ryan, president of the Montana Power Company, Butte, Mont.
Carl E. Magnusson, professor of electrical engineering, Seattle, Wash.
John A. Britton, vice-president and general manager, Pacific Gas & Electric Company, San Francisco.
F. G. Baum, electrical engineer, San Francisco.
Wm. A. Cattell, consulting civil engineer, San Francisco.
Robert Sibley, editor Journal of Electricity, San Francisco.
C. E. Grunsky, consulting engineer, San Francisco.
Chas. W. Merrill, metallurgical engineer, San Francisco.
Bernard R. Maybeck, architect, Berkeley, Cal.
C. L. Cory, professor of electrical engineering, Berkeley, Cal.
H. T. Cory, consulting civil engineer, Berkeley, Cal.
Jos. N. Le Conte, professor of engineering mechanics, Berkeley, Cal.
M. M. O'Shaughnessy, city engineer, San Francisco.
Mark Requa, federal fuel oil administrator, San Francisco.
Harris J. Ryan, professor of electrical engineering, Stanford University.
W. F. Durand, professor of mechanical engineering, Stanford University.
Allan C. Balch, electrical engineer, Los Angeles.
George A. Damon, consulting engineer, Los Angeles.
O. H. Ensign, consulting engineer, Los Angeles.
H. E. Huntington, Los Angeles Electric Railway Company.

The new edition with its 22,968 biographies covering almost thirty-two hundred pages of reading matter is an invaluable acquisition to any library or engineering table for references. It aims to give brief, crisp personal sketches of the most notable living Americans in all parts of the world—the men and women whose position or achievements make them of general interest. It tells just the things every intelligent person wants to know about those who are most conspicuous in every reputable walk of life—birthplace, age, parentage, education, degrees, occupation, position and achievements, politics, societies, clubs, marriage. More attention should be given in the West to this splendid compendium of national biography of the present day.

NEW ELECTRICAL DEVELOPMENTS

(In the Northwest interest centers in the development of city projects and the rapid progress in the electrification of the Chicago, Milwaukee & Puget Sound Railway. Several bond issues have been granted or applied for in the Pacific Central region and numerous power developments of a small size are planned. Irrigation interests and the associated development and use of electricity are featured in the news items from the Intermountain region and the Southwest.—The Editor.)

THE PACIFIC NORTHWEST

BROOKINGS, ORE.—The Mountain Power Company has reduced its capital stock from $1,500,000 to $100,000.

SEATTLE, WASH.—The twenty-five street cars purchased for the Seattle municipal railway have reached the city from St. Paul.

TWISP, WASH.—The Twisp Roller Mills & Power Company has been incorporated for $30,000 by H. C. Lewis, Harry C. Lewis and J. M. Pate.

SEATTLE, WASH.—The bid of the General Electric Company to supply the city with a 400 h.p. synchronous motor for the water department at $3,945 was accepted.

SPOKANE, WASH.—It is considered possible that the federal government may accept the offer of the Washington Water Power Company and establish a nitrate plant here. The plant is estimated to cost $500,000.

SEATTLE, WASH.—A bill was introduced in the city council authorizing and directing the Board of Public Works to enter into a contract with the Puget Sound Traction, Light & Power Company for the purchase of electric energy.

SEATTLE, WASH.—Common user rights on the Seattle elevated municipal street car line under construction to the West Side has been made a condition of the government's loan of $339,000 for the completion of the elevated and the purchase of new cars.

MARSHFIELD, ORE.—The plant of the E. Johnson Lumber Company, recently destroyed by fire, has been rebuilt. The plant will start to operate with 75 horsepower in motors supplied by the Mountain States Power Company, which will very soon be increased to 150 h.p.

MOLSON, WASH.—Ward Brothers, owners of the Molson electric light plant, contemplate the purchase of an auxiliary generator and also a gasoline engine which will be used to relieve the steam outfit in the evening after the peak loads are off until the midnight hour.

SEATTLE WASH.—Preparations have been made by City Engineer A. H. Dimock of Seattle to continue preliminary work on the Skagit power plant all winter. Log cabins are being built to house the men. The surveys for the transmission lines and a railroad to the power site have been completed.

VANCOUVER, B. C.—The courts have decided that the six-cent street car fare, allowed by the vote of the city council to be charged by the British Columbia Electric Railway, was legally agreed upon and must stand. This overrules the refusal of the mayor to sign the bill which was passed by the council.

PENDLETON, ORE.—H. D. Newell of the United States Reclamation Service has been engaged for several weeks in gathering data for irrigation of lands in the western end of Umatilla county. He has made a number of surveys of possible reservoir sites and finds that the most practical are on McKay Creek near Pendleton.

RITZVILLE, WASH.—With franchises granted and right-of-way largely secured, construction work in the vicinity of Ritzville, Wash., for the Mountain Power Company will start shortly. The power is to be delivered at the substation at Taunton, a few miles east of Othello. It will supply power for running the Milwaukee trains over the Cascades to Seattle.

SPOKANE, WASH.—It is reported that the Washington Water Power Company of Spokane contemplates the expenditure of $3,000,000 in the construction of a Niagara system power plant which will place in service all the water of the Spokane river. It will have a capacity of 40,000 horsepower to be utilized for manufacturing purposes.

SEATTLE, WASH.—The substation of the Puget Sound Traction, Light & Power Company at 7th and Jefferson streets was destroyed by fire recently, causing a loss of approximately $100,000. The station contained ten large transformers with the necessary switchboards, dynamos and converters for distributing the current to the different lines.

ANACORTES, WASH.—A force of men is at work on the concrete structure that is to house the new $30,000 steam and electric power plant of the Morrison mill at Anacortes, Wash. The 1000 h.p. turbo engine has arrived from the Allis-Chalmers Manufacturing Company. The box factory and a part of the lumber mill are to be driven by individual electric motors, the energy for which will be furnished by new power installation.

SALEM, ORE.—Application of James H. Sturgis for the appropriation of 50 second feet of water from the Umatilla river near Barnhart, for the development of 284 h.p. to be used for commercial purposes, has been approved by State Engineer Lewis. This project is to involve construction of a concrete dam 7 ft. high and 700 ft. wide ,a ditch 4 miles long and other works, the total cost of which will be approximately $20,000.

SALEM, ORE.—Approval has been given by State Engineer John H. Lewis to an application of James H. Sturgis for the appropriation of 50 second-feet of water from the Umatilla river to develop 284 h.p. for commercial purposes. The proposed project is near Barnhart and the approximate cost is $20,000. Construction of a concrete dam seven feet high and 700 feet long and a ditch four miles long are features of the proposed project.

SPOKANE, WASH.—Equipment for the new street lighting system purchased by the city of Spokane from the Washington Water Power Company has arrived. Installation of the new lamps is expected to start soon so that the system will be in operation early in the winter. The lamps are of the nitrogen-filled variety and will replace the old carbon arcs in use for nearly 25 years. The new lamps will cost the city $37 per year each as compared with $48 for the old style. The ten-year contract calls for 1410 lamps at $52,170 a year.

TACOMA, WASH.—A bill has been introduced in the city council for an issue of $600,000 of utility bonds against the municipal street railway on the tide flats. This issue is to provide for double tracking the line, the creation of a loading station at Tenth street, to pay for the equipment already ordered and to take up all previous issues of securities against the plant. The bonds will mature annually from 1925 to 1934, the first $232,000 to be turned over to the Emergency Fleet Corporation to secure it for the loan it is making the city for the extra development required to handle the tide flat labor for war industries.

SEATTLE, WASH.—The board of county commissioners of King county has granted the Chicago, Milwaukee & St. Paul Railway Company a franchise to construct transmis-

sion lines for electric power from Snoqualmie Falls to Cedar Falls and from Snoqualmie Falls to Renton Junction via Preston, Issaquah and Renton. The franchise is granted for 38 years. The wires are licensed to carry 100 volts and the power is to be used for the electrification of the company's lines from the Cascade summit to its coast terminals. Construction of the lines has already started under a temporary permit. They will cross the highways in 50 places, the franchises calling for 35-foot clearance at these crossings.

SEATTLE, WASH.—The issuance of $1,755,000 of light and power utility bonds for further extensions of the light and power system in addition to the $5,500,000 authorized for the development of the Skagit river power project is provided for in a bill introduced in the city council and referred to the City Utilities and Finance committees. This amount is considered necessary to pay for the physical connection between the city's power plant and the system of the Puget Sound Traction, Light & Power Company; the retirement of warrants issued for light and power extensions and for further extensions that will be required from time to time to meet the demands made for electric energy from the city plant.

THE PACIFIC CENTRAL DISTRICT

SANTA CRUZ, CAL.—The Cain Electric Company has changed its name to the Blide Electric Company.

SACRAMENTO, CAL.—All bids submitted for equipment for an electrically driven pumping unit at the city water works station have been rejected by the city council.

FRESNO, CAL.—W. H. Henderson has purchased the 310-acre grain ranch of R. M. Shannon near Herndon in Madera County and intends to complete the pumping irrigation system and to water practically the entire tract.

RIO VISTA, CAL.—The Great Western Power Company has made a survey of the Maine Prairie Tract, north of this city and has submitted estimates for the construction of a 22,000-volt power line into the section. The work will begin soon.

SAN FRANCISCO, CAL.—To facilitate telephone connections with the Board of Health, the Board of Supervisors authorized the employment of two extra switchboard operators at a salary of $90 a month. Two additional trunk lines have also been installed in the Board of Health's office.

SAN FRANCISCO, CAL.—Pacific Gas & Electric Company earnings during September show an increase of more than $30,000 over September last year, although the 12-month period ending September 30th discloses a drop of more than $400,000 compared with the corresponding period of the year before.

OAKDALE, CAL.—The Booster plant, which supplies 3000 acres of highly cultivated land in the Oakdale Irrigation District with water, is to be rebuilt. The syphon is of peculiar construction, taking water from one hill through the valley to another hill, and is one of the longest pieces of concrete construction in the state.

LINDSAY, CAL.—Only two bids were received for the issue of $250,000 Lindsay-Strathmore Irrigation District 6 per cent bonds offered at public sale last week. The higher of the two bids was at 90 and interest. Both bids were rejected and announcement was made that the bonds would be re-advertised for sale within 30 days.

IONE, CAL.—Farmers and other residents of Dry Creek, Jackson Creek, the Mokelumne River section and the Ione district have organized to protest the proposed Dry Creek irrigation project. The farmers declare their homes will be inundated and ruined and that their land will suffer likewise if the project is carried out.

SAN FRANCISCO, CAL.—The Board of Supervisors has accepted the statement of the United Railroads of San Francisco showing that there is due to the city $31,048.02 on account of percentage of street car fares for the year ending December 21, 1917. The United Railroads was directed to pay this sum into the city treasury.

SUSANVILLE, CAL.—The Southern Lassen and Long Valley irrigation projects probably will be amalgamated at a meeting early in November. This action is expected to follow a recommendation to the Northern California Counties Association from the Federal Government that all feasible water projects be constructed as part of the reconstruction programme.

SAN FRANCISCO, CAL.—Confirming the agreement effected between the Municipal and the United Railroads officials concerning the operation of cars over the three loops at the Ferry Building, the State Board of Harbor Commissioners has passed a resolution governing the operation of the cars and requiring the payment of $1000 a month from the United Railroads during the term of the authorization.

SAN FRANCISCO, CAL.—The San Joaquin Light and Power Corporation has filed application with the State Railroad Commission for authority to reimburse its treasury, in part, for capital expenditures made subsequent to December 31, 1916, out of the proceeds of $114,672.45 par value of its series C 6 per cent bonds, which have already been authorized by the commission. The balance of the proceeds are to be used to pay off indebtedness.

CHICO, CAL.—Work will be commenced in about ten days on the construction of a $50,000 irrigation system which will water 3000 acres of the Phelan ranch, according to announcement made by M. C. Polk, City Engineer of Chico, who has charge of the work. Bids are being taken for ditching and piping. The contract for the pumps has been awarded to the Byron Jackson Iron Works, 55 New Montgomery street, San Francisco. Motors were awarded to the Westinghouse Company.

OAKLAND, CAL.—Announcement was made recently by W. R. Alberger, vice-president and general manager of the San Francisco-Oakland Terminal Railways, that in addition to the 51 new street cars being built in the east and the ten trailers being built by the company in its own shops at Emeryville, that the company had purchased 10 street cars from the street railway company at Spokane. These cars will be shipped immediately to Oakland and put in service to and from the shipyards.

BRIDGEPORT, CAL.—By virtue of an agreement reached in the long-drawn litigation between what was formerly the Miller & Lux interests and over 150 defendants in Mono county, California, and Mineral county, Nevada, work on an extensive irrigation and reclamation project in those counties is expected to start at once. The plan includes driving a tunnel to tap the waters of Alkali Lake and the building of storage reservoirs. The cost of the system is estimated at $200,000, and impounding of 80,000 acre-feet of water is to be accomplished.

SAN FRANCISCO, CAL.—Application has been made by the Great Western Power Company to the State Railroad Commission for authority to refund its $350,000 promissory note in favor of the Bankers Trust Company of New York and due November 7th. This note is secured by a pledge of the company's first mortgage bonds. The authority asked from the commission is either to give a new note due six months from date or to negotiate a like loan on the same security from some other bank or trust company and with the proceeds repay the Bankers Trust Company.

SAN FRANCISCO, CAL.—Among the orders issued by the Railroad Commission, was an increase in rates to the Sierra and San Francisco Power Company, which has for its principal consumer the United Railroads of San Francisco. The schedule of surcharges fixed by the Commission follows: For energy sold for municipal street lighting, 15 per cent of monthly bills. For energy sold for residence and commercial lighting, 1½ cents per kilowatt hour. For energy sold for power including heating and cooking, 3 mills a kilowatt hour. For energy sold for electric railways, 1½ mills a kilowatt hour. For energy sold to other electric utilities, excepting

Coast Valleys Gas and Electric Company, 1½ mills a kilowatt hour. For energy sold to Coast Valleys Gas and Electric Company, 2½ mills a kilowatt hour.

STOCKTON, CAL.—The directors of the Turlock and Modesto irrigation districts are considering the construction of a storage reservoir to be known as the Don Pedro storage reservoir and which when completed will hold 260,000 acre ft. of water. While the first purpose of the reservoir is to provide water for irrigation, the development of electric power from the flow of the water into the river is included in the general plan. The engineer reports that the flow of water can be regulated from 750 second ft. or perhaps 1000 second ft. to 4000 second ft. This latter figure represents the maximum flow during the height of the irrigation season. This flow of water, it is estimated, will develop from 6000 h.p. to upwards of 30,000 h.p. of electric energy. The plan also includes a provision for pumping water to the higher lands by means of the power to be developed at the reservoir from the flow of the water.

OAKLAND, CAL.—The advisory board in the matter of the street railways resettlement franchise made its report to the Oakland City Council and paved the way for a valuation of the properties of the San Francisco—Oakland Terminal Railways by the State Railroad Commission, to be used as a basis for future relations between the city and the company. The proposed franchise provides for creation of a board of control, to operate the property. This board consists of two members, one appointed by the company and the other by the city. In case of disagreement the members are empowered to select a third person, to act as arbiter. The franchise makes possible the acquirement of the system by either lease or purchase by the city and further provides that the city shall have 55 per cent of the net profits, over and above certain fixed charges to be based upon the Railroad Commission's valuation.

THE PACIFIC SOUTHWEST

LOS ANGELES, CAL.—The Pacific Electric Railway Company is to build a double track railroad at grade in Harbor Boulevard and across Bay street, San Pedro.

PHOENIX, ARIZ.—Layne & Bowler Company, of Los Angeles, has been awarded the contract for supplying pumps for the Salt River Valley Water Users' Association. Contracts for electrical equipment will be let soon.

SEELEY, CAL.—The Utah Construction Company is preparing to build a telephone line from El Centro to the grading camp in the mountains. This will be a private line exclusively for the use of the construction company.

OCEANSIDE, CAL.—The city of Oceanside is installing electric pumps to operate its water system on account of the increasing cost of fuel. The electric energy will be supplied by the San Diego Consolidated Gas & Electric Company.

EL CENTRO, CAL.—The Holton Power Company is planning to spend between $50,000 and $100,000 in repairing the Holtville auxiliary plant in the near future, providing the company can get 150 second-ft. of water daily continual flow from the Imperial Irrigation District.

SAN DIEGO, CAL.—In connection with the construction of the proposed new marine brigade post on Dutch Flats, by the Government, arrangements have been completed for the installation of an electric lighting system.

BEAUMONT, CAL.—The Water Users' Association and a majority of property owners have petitioned the Board of Supervisors to call an election for the purpose of voting on the proposition of developing an irrigation project in this district. The matter will probably be acted upon shortly.

LOS ANGELES, CAL.—The C. A. Kubach Co. has been awarded a contract by the Western Union Telephone and Telegraph Company for the alteration of a five-story Class A building at 608 South Spring Street, Los Angeles. The Otis Elevator Company will install a new electric elevator. The estimated cost is $20,000.

OCEANSIDE, CAL.—At a recent meeting of the board of trustees the matter of putting in an electric power plant for use in pumping was discussed. Preliminary specifications as prepared by A. S. Glasgow, local manager for the San Diego Consolidated Gas & Electric Company, call for a plant capable of furnishing about 45,000 gallons per hour. No definite agreement was reached.

SAUGUS, CAL.—Leonardt & Peck, Los Angeles, have been awarded the contract for the construction of an extensive irrigating system at Saugus for the American Sugar Beet Company. About a mile of large reinforced concrete pipe will be laid and also a large amount of smaller concrete pipe for laterals. Reinforced concrete reservoir and numerous small structures incidental to irrigation work are included in the contract.

LOS ANGELES, CAL.—August seems to have been an exceptionally bad month for the Southern California Telephone Company, according to the company's income account. The total operating revenue in August was $337,634, a decrease of $35,362 from the figures for August, 1917. The net operating revenue was only $8268, or $96,175 less than in the corresponding month last year. The operating deficit for the month was $20,436, an increase of deficit of $97,336 when compared with the results of August, 1917.

LOS ANGELES, CAL.—An ordinance has been adopted granting the City Railway Company of Los Angeles a franchise to construct and maintain for a period of not to exceed 21 years a double track electric street railroad upon the following streets: Beginning and extending from a connection with the West Tenth street line southerly into Victoria avenue, southerly along Victoria avenue to the Country Club Drive, westerly along the Country Club Drive to a point four hundred and fifty feet east of the line of Rimpau Boulevard.

THE INTER-MOUNTAIN DISTRICT

COEUR D'ALENE, IDA.—Steam as a motive power in the Northern Pacific yards is being replaced by electricity within the city limits.

PETERSBURG, COL.—The power house of the National Alfalfa Products Company of Petersburg, between Petersburg and Littleton, was recently destroyed by fire.

HUNTLEY, MONT.—On the Ballantine auxiliary pumping plant a small force of carpenters completed the building and built a wagon bridge over the force pipe. The Bucyrus drag line excavator was loaded on cars and shipped to the Shoshone project.

PAUL, IDAHO.—The Paul substation of the Minadoka Irrigation Project was energized on August 26. Three steel towers for outdoor substations were erected, and pole-top switches and lightning arresters installed. There were six interruptions to the delivery of power from the power house. The most serious were one of 55 minutes caused by a heron flying against the line and burning it down; one of 1 minute being a short in the oil switch at second lift; one of 10 minutes caused by a heron flying into the line near Heyburn, and one of 2 minutes caused by a hay derrick coming in contact with the line.

BOISE, IDAHO.—Substation, camp, machine shop, office and supply depot on the Boise Irrigation Project have been completed. Transformers were installed and power turned on for the first time August 22, everything working well; 12 miles of three-phase transmission line have been completed from Snake River crossing to Wilder, including a double circuit on 2 miles. A 3-mile branch circuit was built on the Welch drain section; 6 miles of three-phase copper circuit were strung on power company poles between Nyssa and Kingman Colony on the Oregon side of Snake River crossing, 1,000 feet, and completed for connection to our substation.

THE VACUUM CLEANER —— THE VACUUM CLEANER

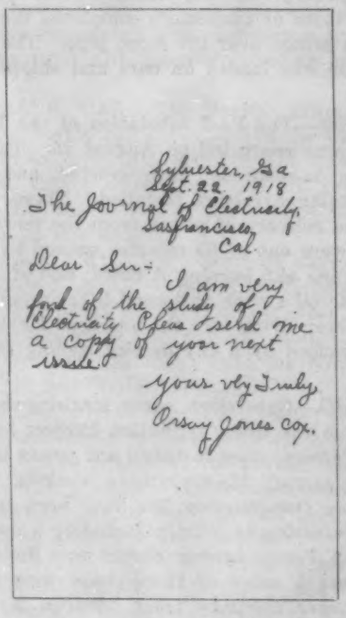
A MAN DOESN'T ALWAYS TELL HIS WIFE all that happens during the day, nor does an editor put everything he knows into his columns. As a matter of fact it is often the most picturesque, if not the most interesting items that are omitted from both accounts. The new hat of this jobber or the good joke on that manufacturer is laughed over between friends, but the dust heap gets the item in the end. And then the Vacuum Cleaner devours the dust heap—and here are bits of those fragments supposed unaccountably lost which our electrical janitor retails for the benefit of the readers of the Journal of Electricity.—The Editor.

If it isn't the Liberty Loan, it is the conservation movement. We suspect from the variety of stimuli which result in electrical poetry that the poetical germ lies dormant in the most of our neighbors. Here is a pome that F. D. Fagan sends in:—

PATRIOTIC CONSERVATION

We've no respect—and rightly none
For one who tries to help the Hun;
Yet every now and every then,
We see a carbon lamp or ten.
It's true these lamps do furnish light
And aid in vision and in sight;
And yet, if asked our leader Foch
Would rightly say, "They aid the Boche."
For carbon lamps take thrice the amps
Required by the Mazda lamps
Of equal lumen output, and
They eat up coal to beat the band.
Last winter, all our stores were cold
One day each week, and we were told
The coal so gained at once for use
Was needed like the very deuce.
Yet in the shops throughout the land,
The carbon lamp has not been canned;
It eats the juice in bales and reams,
And gives out heat instead of gleams.
This fact upon your memory fix—
Thrift Stamps and carbon lamps don't mix;
The one helps out the Nation's roll;
The other wastes your country's coal.
Use Mazda lamps throughout the land!
Proclaim the carbon lamp is canned!
One-third the coal for equal light!
Two-thirds to cure the Kaiser blight!

J. R. COLVILLE,
Eng. Dept., Nela Park.


Sylvester, Ga
Sept. 22 1918
The Journal of Electricity
San Francisco
Cal
Dear Sir:- I am very fond of the study of Electricity Please send me a copy of your next issue
Yours Very Truly
Orsay Jones Cox.

With becoming modesty the Journal of Electricity printed only a few of the letters it has received in that "Jubilee" issue of a month ago. There are many others of congratulation and comment much too personal to be made public. This little note on ruled paper from Sylvester, Georgia, is among the more humble of these communications, but it is nevtheless appreciated as indicating to what distances the Journal of Electricity's fame has spread.

E. B. Walthall, assistant general manager of the San Joaquin Light & Power Corporation and chairman of the commercial committee of the Pacific Coast Section, N. E. L. A., has recently been at last gagged but not gassed. Here he is shown in the right of the picture wearing the mask that accomplished this

result. The view is that of the Fresno office force of the San Joaquin Light & Power Corporation, dolled up in their influenza masks. Mr. Walthall, as chairman of the commercial section of the Pacific Coast Section N. E. L. A., has been collecting data on the relation of electrical business to the war and reconstruction conditions, some of which will appear in the Journal of Electricity — when the mask is removed.

How an Editor gets rich was disclosed by a recent quotation from a Kansas paper and the title at least was so startling that it deserves repetition here. It seems there was once a country editor who was able after twenty years of service to retire with the fortune of $50,000. This was due to his patience, his tireless energy, his fairness in giving value received for the subscription price of his paper, his perseverance in the face of difficulties, his indomitable will to succeed and the death of an uncle who left the editor $49,999.50.

Winter is no time, perhaps, to introduce the subject of electric fans, but then we have been learning of its other-than-summer uses. Among other things it may serve as an example to children and their elders as is pointed out by this verse on the fourth of our wild electrical menagerie.

THE ELECTRIC FAN

Fans are supposed to go around
And do a lot of yelling.—
Here's one that spins without a sound,
With air (not hot) excelling
He keeps as cool as any man
When others do perspire.
This revolutionary fan
All children should admire.

THE VACUUM CLEANER —— THE VACUUM CLEANER